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THE RELATION OF COMMON AND NATIONAL AGRICULTURAL POLICY

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If we are speaking about the interdependence between common and national agricultural policy, we have to concern our moving possibilities in this particular branch. At the first sight we can reveal that narrow is the path to balance our actions. If one asks about proportions, it can be estimated that about 30-40 % of our agriculture is determened by the world market, an other 30-40 % by the common agricultural policy, and perhaps 20-30 % remains for us to enforce our wish and imaginations. Is it reasonable to pool our national sovereignity in this extent after joining the EU?
The Common Agriculturtal Policy has particularly high importance in agriculture and rural developement, because this is the area where comprehensive regulation for supports, and market relations exist. But because agricultural policy is created in Brussels, have we to do nothing else but to keep the common rules? No! Even we oblige to enforce our own particular interest in the legislation. The main question is: do we have any possibilities for national arrangements within the frame of Common Agricultural Policy, in wich area, and in what extent?

WHAT ABOUT SINGLE MARKET?

First of all, one has to emphasize that the target of Common Agricultural Policy is to operate a succesfull single market first of all for the sake of consumers. Beside this it endeavours to ensure market stability for farmers to escape disturbances by influencing the output of goods by means of market instruments. Parallel by the operation of the single market, the long term sustainability of production plays more and more growing rule. From the point of view of the worldwide lack from energy, nowdays the attention is directed also to the fuel gained from agriculture. If we approach the theme one-sidedly, unbearable burden can stress the natural environment, wich has to be escaped.

We take part in the decision-making actions of the EU, so we have the chance to influence the legislation procedures, especially if we cooperate with other member states having similar interest. For example it had been carried through successfully in the course of the budgetary negotiations. It has to be underlined, that mutual agricultural policy can be realised above all through national approach. Beside the possible influence of common decisions, the areas, wich stood in national competence, have to be treated prominently. Taking these areas one by one we find out, that we are facing very relevant elements. The common and national agricultural policy has to be harmonised. This is the condition and garantee to develop and sustaine our agriculture for long term. That needs continous cooperation with farmers, mostly in the frame of extension service. A well-organised advisory system, including well-accomplished experts can be pawn to close up successfully for earlier member states in agricultural producion.

Wich are the most frequented branches of policy that remained in national authority? We have to regard one by one the most stressed areas, for example the cooperatives, land-policy, tax-mechanism, national support possibilities, tayloring agricultural structure, international relations, vocational teaching and training, scientific research work, just to mention the most distinguished topics. In each case we have to find out and elaborate how to organise proper consultative system, in wich geographical distribution, by what type of experts. It is not an exaggeration to accentuate the importance of advisory management. That means new perspectives for the existing regional extension service centres, but those have to renew and rejuvenate themselves, according to the challenges of the continously changing CAP reforms.

THE CONSUMER-MARKET OF THE NEW MEMBER STATES IN THE CENTRE OF INTEREST

It is not correct to attribute to the accesion an appearance, as if after historical storms our country finally arrived into a safe harbour, and this was our mean target. It has to be underlined, that the enlargement is fundamental interest for the EU, too. Our continent is constrained to launch into competition with the overesees powers, for the time being not with a lot of success. For that it is unsufficient to start from the present situation, but strategical thinking is needed. Europe is not Europe without the integration of the twelf new, and the future members. If those would have been remained outside the EU, their closing up falls behind, so they would become a withdraval power. In the lack of solvency they do not enlarge the market of the EU, and have less chance for tayloring themselves to the procedures of globalisation. Their closing up can be realised only by integration with the other EU countries. The fate of globe is determined by the big powers, and Europe cannot be a big power without Middle and East-Europe.

Consequently, the EU is in a position of necessity. Statistical datas reflect obviously its backwardness in the area of economic growth, and this seems to be a longtrm phenomena. Accordingly, the enlargement for the EU is not a noble gesture, but basic interest, even historical liability from certain point of view. West-Europeans don't hear this pleasantly, but there is no reason for us to be modest, because we do not wait allowances, but fair treatment. The standpoint, that we were, who desired to join the EU, and a result of this our obligation is to adjust ourselves completely, can be accepted only by sustenance. Surely, we have to taylor ourselves, but not on the account of our agriculture. In this line we expect mutuality, with right. The Roman saying, that „if one intends to go to Rome, has to behave as a Roman", but it is not a Bible.

Concerning that the industrial and food products of the most developed countries of Europe can stream unhinderedly to the market of the new member states, it is obvious, that the realised extra profit compensates aboundantly the rich member states for the money, paid into the EU budget. This is aproximately 1 % of their GDP, wich appears to be symbolic, especially if we count it pro capita. An important part of our EU support derives from the Hungarian taxpayers' pocket, because we don't get much more payments from the EU, as much we pay into the EU budget. So only the surplus derives from the taxpayers of other member countries. From the above-mentioned follows some relevant issue. If the EU represents and enforces the interest of its taxpayers stone-hardly, so we can not be condemned, if we do the same. We are not allowed to underestimate our national

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agricultural policy, even we have to attribute more importance to that. One commits failure if considers the agriculture neglectable, turning money only according to the proportion of the national economy. At the same time the EU has recognised alredey that the rural sphere is not only economical but at the same time sociological question, the importance of wich cannot be always expressed in figures.

THE ROLE OF THE ECOLOGICAL BACKGROUND OF AGRICULTURAL REGULATION

The EU has been founded by countries wich have predominantely oceanic climate. Accordingly they lay high weight for the pasturing cultures and ruminants. They consider poultry and pig keeping almost as industrial activity, and comprehend it as „processed cereals". That sounds attractive, but it is not true! They forget and neglect the genetical and multiplicational background of that particular branches. Perhaps we would convince them, that if they need the markets of ten countries having continental climate, the special interest of them can't to be neglected. We are not able to base our animal keeping on pastures, because the Hungarian pastures are not suitable for that. We tried that many times unsuccessfully. We have to utilise our cereals in the first place by pigs and poultry, otherwise because of absence of see harbour, and the limited transport possibilities we loose our comparative advances. The position of the crop-consumer animals have vital importance for us, therefore we must concentrate similarly, as the EU does for it's own specialities. It is untolerable, that Hungary is forced to export its cereals uneffectively, because of the absence of direct payments for the pig and poultry branches. As a result of this, rural areas, small regions can go down, wich is contradictionary to the cohesional policy of the EU, targeting the closing up of the backwarded areas. We have to find solution for our neglected branches, not by protectionism, but through improving natural figures, and by stronger competitiveness. This is an important obligation of the national agricultural policy.

Do not misunderstand, we are ready to keep the directives of the Common Agricultural Policy, being basically interested in the uniformed, transparent roles, and honest behavior on markets. Simultaneously we have to enforce the possibilities, wich promotes the position of the crop-consumers without going against the principles of the EU.

HAVE WE TO ACCEPT THE FREE STREAM OF CAPITAL AND COMMODITIES?

Some people think that national agricultural policy is nothing else, but to refuse all, wich is not home-made, and they step with particular intensity against the import of agricultural commodities, and against foreign investements into agriculture. Instead of a technical aproach, for instance the food import led often into demonstrations, and the land market became political battlefield, the economical standpoint of wich induces furious opposition in many people.

Hungary can be proud of being a netto food-exporter. If we want other countries to buy agricultural goods from us, we can't lock ourself to purchase things from abroad, despite injuring the interest of some producers. „Interest protectors" demand for example, not to

bring pork into the home market, but expect for other countries to buy their corn surplusses. The world market does not operate in this way. Who doesn't wish to keep the rules of the game, disqualifies itselves from the international division of labour. It doesn't mean, that to protect our market is not allowed. The western countries do that, introducing very sofisticated technics to prevent their market from the import of goods, as we have experienced bitterly so often. However, we have to see that the import-limitation causes unfavorable consequence to our export. The lack of competitiveness cannot be compensated by administrative prohibitions.

We pay foreign working power in each imported goods. It can be equalised, if we let other countries pay more and more Hungarian working power. This system has been operated up to our accession. But after, in the last years, we could notice opposite tendencies. The proportion of the export-import decreased dramatically. This phenomenon must be turned back. It is fundamental interest that all the food, which can be manufactured in Hungary, possibly must be produced here, paying local working powers instead of foreigners. It happens then, if Hungarian farmers can close up on the area of competitiveness.

We have to consider that the basic element of market economy is to ensure the free streeming of capital. If it doesn't operate, we can't speak about market economy. Hungary undertook to ensure the preconditions for that. To invest capital into agriculture testifies mainly purchasing arable land, and this action as negative discrimination, can't be prohibited for companies and the citizens of other EU countries. This is one of the basic principle composed in the „aquis communaitaire", but the member countries are allowed to issue the national preconditions of land market liberalisation. This is also a part of the national agricultural policy. The big reformer Széchenyi in 1830 in his book „Credit" spoke about the lack of capital, caused by the limitation of land market. We are wrestling with this particular topic since those time. As after 2014 to buy land by companies and EU citizens will be legal, we have to find public agreement to prevent land turnover from speculation. The interest of agricultural investors has to be harmonised with the rightful demands of rural people.

One of the reason of declination of our animal husbandry is, that for our big companies dealing with livestok is not allowed to have land, wich would be necessery to produce green feed and to deposite manure. The land leasing system is not a reliable garantee for that. The disappearance of livestock from numerous Hungarian farms can be disasterous also for crop producers because there is no livestock to feed. This topic has to be particularly emphasized in the national agricultural policy.

THE CORRECT MONETARY AND FISCAL POLICY AS NATIONAL OBLIGATION

An important part of financial support and national resources can be found in the Hungarian budget. The experiences reflect that to reach these resources is not easier than to be able to get them at EU cash-desc. The forever floating, parking, postponing and pulling out payments and terms by the government causes losses and unsatisfaction in farming and decreases the reliability of public institutions. The sums and conditions owe to farmers „have to be graved into stones", and fulfilled in time, instead of uncertain and foggy explanations. When required, political decision is needed. It is not lucky, that in the case of

matters having vital importance for the society, administrative circles make decisions about financial resources. It is not necessery to wait, that the decisions will be forced by demonstrators. Because the payments derive from public money, it would be a natural demand to publish the preferentiated persons or companies and the assigned sums. In a country, where the allocation and tax payment is not public, we hardly can speak about transparency. It would be also a part of national agricultural policy.

We can't disregard from the fact that among the twelve new member states Hungary is a net exporter of agricultural products. Therefore the government is somehow responsible to help preserving this heritage. The strong national currency took out many billions of forints from the pocket of food industry, ultimately from the pocket of farmers. We often forget to speak about losses and impacts caused by unfavorable monetary policy for the agriculture, however they are independent from the will of farmers, like drought or hailstorm, but can induce bigger troubles than those. Export-oriented, drawing branches went to floor, perhaps finally. The strong forint is unfavorable fore exporters. A responsible national agricultural policy would be able to concern about it.

NO CHANCE FOR US WITHOUT COOPERATION AND INTEGRATION

The spreading supermarkets brought decisive change in food industry. The market is operated more and more by these multinational firms, reaching decisive share of the food market, and dictating all the objectives, mostly the prices for the food industry, despite it is mostly in the hand of multinational firms. On the other side thousands and thousands of small-scale farmers are fighting lonely, with lost hopes, without perspective. They have no chance to be equal partners for the supermarkets and money-world. Their societies are divided, often discuss with each other, instead of understanding and elaborating mutual strategic imaginations. Their main task would be to stop dividedness of agrarian-world.

In western countries the political and economical interest of producers are represented by cooperatives, in most cases successfully. In our case political mistake led to the present stage, the lack of cooperatives. Some politicians interpret the former Hungarian collective farms as kolkhozes; causing big damages in the heads, removing small-scale farmer's mentality from the chance of survive. Some years ago the Hungarian Parliament created a new "Cooperation Law". That can be a frame, but it has to be fulfilled with content by the farmers themselves.

NO RESULT WITHOUT TECHNICAL KNOWLEDGE

The value of up to date knowledge is increasing everywhere. Consequently to restructure and re-tailor our educational system to the always changing requirements has vital importance. We need not old-fashioned farmers, but competitive, constructive, well accomplished managers. It isn't enough only to harmonize the educational scheme with the EU. One has to estimate the demand of the particular professions, and adjust the proportion and level to the practical demands. One has to shape the desirable share of teaching and research activities within the higher education, considering that we are operating in market economy. The vocational teaching and training is also a part of the national agricultural policy.

Hungary can appear in the single market with particular products having local characteristics to increase the choice. To realize that it's necessary to have plant and animal varieties, bred especially for our local ecological conditions. The research work has to be targeted into this particular direction instead of the present diversification. We have to mention, that regional extension management will be built up within short time. The practical knowledge has to be forwarded to farmers.

Though we repeat continuously that the best investment is education and research, unfortunately we neglect to enforce that particular principle in the practice. Our educational and research institutions are fighting with every-days financial disturbances. To support that area is not prohibited in the EU, so the national policy has the task to discover possibilities to improve the situation. The Bologna-process alone is not able to do that. We have to reorganize the system of vocational education, maybe on market-basis. We have to make clear for students that their future living standard and life-quality depend on their efforts and spiritual-economic investments. All that must encourage students and scholars alike for higher achievement. Remember that the educational policy remained in the competence of member states.

THE INTEREST OF THE FOOD ECONOMY IS INDEPENDENT FROM DAILY POLICY

We prepared ourselves more than ten years to be member of the EU. The chance to gain supports is given for every ruler of the production, but the illusions of easy money disappeared slowly. Only the possibility is given, the utilization needs a rank of new knowledge at home, and hard advance in the European Parliament. Two different types of agricultural policy can't be represented simultaneously. In the question of agriculture we would rise above the egoistic political interest, because we have only one agriculture, which is quite vulnerable, and because agriculture is the fate of rural areas. The discussions have to be placed to practical basis involving the touched people, and to create a situation near to consensus for the sake of the future of inhabitants in the countryside.

As a matter of fact, well-articulated and strong agricultural and rural policy at national level is not only a chance, but also an obligation for us. That's what we have to serve!

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FINANCIAL INNOVATION IN AGRICULTURE

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ABSTRACT – Financial innovation in agriculture
The process of financial innovation is a patchy phenomenon, far from exhausted, that has left some areas of the agribusiness almost unaffected. Looking at the financial arena as a huge laboratory, a set of new tools could be taken advantage of, in order to exploit the potential of finance and hence to speed up the flight to quality in agriculture, well beyond the scope of agricultural lending; these tools include weather derivatives, cat bonds, micro-finance, mutual guarantee institutions, and the JEREMIE (Joint European Resources for Micro to Medium Enterprises) initiative.

After identifying the strategic areas of the financial system that are likely to prove most beneficial to the agribusiness, the toughest task has to do with making all relevant information available to the small enterprises prevailing in agriculture, not to mention the micro ones. A success story has been developed by the Louisiana Business & Technology Center in Baton Rouge (LA, USA) after Hurricane Katrina: a *mobile classroom* was set up to reach the unserved parishes in rural Louisiana with counselling, encompassing managerial finance, and also to be utilized as a *business incubator on wheels*.

The use of this 30-seat converted semi-trailer entails an innovative way of delivering financial assistance and services: therefore, it can be taken for a meaningful change in the *place* factor of the marketing mix traditionally resorted to by banks and, as such, may fit into the concept of financial innovation. The ambitious results attained over there do not only give satisfaction for international interest, but also sound like an invitation to replicate them by adopting this case study as a contribution to foster long term, sustainable growth in agriculture.

Keywords: cat bonds, financial innovation, JEREMIE, micro-finance, weather derivatives

INTRODUCTION

The empirical evidence justifies the statistical studies that describe the service industry as one of the three economic sectors and label it as the tertiary sector of the economy; the secondary sector is approximately the same as manufacturing whereas the primary sector consists of agriculture, forestry, fishing, and extraction such as mining. The activities performed in the service sector basically aim at improving productivity, performance, potential, and sustainability by using knowledge and time.

A substantial shift has been observed for the last thirty years from the primary and secondary sectors to the third one in industrialised countries; actually, economies tend to follow a pattern evolving from heavy reliance on agriculture and mining, toward the development of manufacturing (for instance: automobiles, textiles, shipbuilding, and steel), and finally toward a more service-based structure. As a result, the service industry is now the largest and fastest growing sector of the economy in the Western world.

Banking, insurance, and – in more general terms – financial services spearhead the market segments in this industry. However, the situation is not as clear-cut as it might seem: despite the categorizations set forth, there are links between the financial arena and the primary sector that deserve much more attention than they have been paid so far; this is

especially true of Italy, where agriculture has been characterized historically by a series of inequalities, both regional and social.

A few remarks

To make a long story short, the majority of agricultural workers struggled under harsh conditions as waged labourers or owned derisory plots of land, too small for self-sufficiency until the middle of the nineties. Afterwards, large tracts of land were redistributed to landless peasantry, which allowed to absorb greater amounts of labour and encouraged a more efficient land use; nevertheless, many farms are still undersized and, as such, not viable.

Additional drawbacks stem from being most of the firms in the primary sector owned and operated by families. No surprise that managerial criteria do not fully display their potential in agriculture: in particular, finance can be expected to speed up the flight to quality in this market segment, being money an essential input as well as a scarce resource worldwide; in turn, financial innovation is likely to upgrade the way in which the agribusiness is currently managed and hence to spur its long-term, sustainable growth, not only in Italy.

Based upon these thoughts, it must be recognized that both scholars and practitioners have tried to cope with emerging issues in managerial finance for a long time, thus generating a remarkable quantity of high quality information; however, much room remains for financial management to progress in the agribusiness and the unexploited opportunities cannot be overlooked under the troublesome conditions that continue to affect the economic scenario. Therefore, the main goal is to contribute to bridge the gap between theory and practice, as far as promoting a more massive recourse to the best practices that the financial side of the service industry can make available to the primary sector, with the local perspective to be properly combined with the global one, according to the *glocal* approach.

MATERIAL AND METHOD

Toward this objective, the starting point can be identified with a critical overview of the empirical research and theoretical models developed in the field of financial innovation, so as to end up with a survey of the most innovative features of the financial system. The next step has to do with sorting out the strategic tools that are best suited to satisfy the financial needs of the small companies prevailing in agriculture, not to mention the micro ones: in a few words, it is a matter of realizing what's new in the financial arena that these firms might most take advantage of.

Giving priority to the real-world problems in the agribusiness, the most challenging issues deal with how to channel all relevant information to end-users, such as farmers scattered throughout the country, including micro enterprises located in areas where it would be hard to find a bank branch; this exercise could prove even tougher if it had to be carried out in a disaster management framework, which by the way agriculture should not feel unfamiliar with, being a weather sensible market segment. All in all, it is worth assessing how firms that belong to the primary industry can be made aware of the most innovative ways designed to improve their financial management, given their traditional profile, and can be finally induced to rely on these financial tools, so as to benefit from them as much as possible.

In anticipation of the wide choice of encouraging results that this investigation is likely to produce, it should be extended to how to replicate them, which is another exacting

task: by common opinion, experiments are reserved to applied sciences and thus excluded from the methodological set available to finance; yet, the practical outcome, consisting of a more massive recourse to financial innovation in agriculture, should be greatly appreciated. The positive effects that this ongoing process might possibly generate in the primary sector – as well as in any other industry – promises to make the required efforts rewarding, in sight of fostering sustainability and growth in the agribusiness over the long run.

Highlights of the process of financial innovation

For the last fifty years financial innovation has been deeply transforming the financial system as a whole and each of its pillars, namely financial services, financial institutions, and the market segments that the financial arena is made up of (FORESTIERI G., MOTTURA P., 2005). Assuming the broad perspective that the global competitive challenge imposes, any change in these elements can be classified as a sort of financial innovation, including new ways of delivering traditional financial services: it is not just a case that the spread of information technology has prompted *process innovation* in the financial industry since the eighties (CARANZA C., COTTARELLI C., 1986), to the benefit of both suppliers and consumers of financial services; further developments are on the cards, as implied for example by the advent of what has become known as *e-finance* (MISHKIN F. S., EAKINS S. G., 2009).

The financial crisis that began in the summer of 2007 caused – among other things – a big financial squeeze, that triggered a global brainstorming about the future of both traditional and alternative funding channels, caught between uncertainty and instability. Since the financial sphere of the economy is assumed to efficiently support the real one, the underlying question that has been gaining momentum is whether banks are enough: for sure, they keep on performing vital functions but non-banking institutions have increased their competitiveness by supplying even too creative products, in an effort to sustain company liabilities and to assist the same target market with risk management techniques.

At the same time, the issues concerning risk management have been increasingly dealt with, to the point that nowadays risk is perceived as a multifactor concept to be analysed from several perspectives. As a consequence, its theoretical roots have been explored in different fields, well beyond the original scope of the insurance industry and its own actuarial and statistical framework: for instance, the topics that have been most recently covered in corporate finance aim at studying risk within the value maximization context and at developing strategies for mitigating risks; by contrast, banking has been more and more concerned with risk capital and capital requirements, as the reform of the 1988 Basel Accord culminated in what bank supervisors refer to as Basel II (BANK FOR INTERNATIONAL SETTLEMENTS, 2004), and the call for Basel III should further enhance the role of risk assessment and measurement, thus compounding fears of credit rationing among borrowers.

Recent developments in the agribusiness

Investigating boundaries and manifestations of such a blurred concept as financial innovation can provide an idea of just one side of the coin; on the other side, attention has to be focused on the financial needs that remain unsatisfied in agriculture or that are worth stimulating to attain a higher level of managerial finance standards. As a matter of fact, innovation has made both agriculture and finance extremely diversified sectors, as it can be argued by pointing at agricultural loans, though the process of financial innovation has left some areas almost unaffected in the agribusiness and its management skills need to be improved in a way that is *right for the times*, in general terms.

As if the options that have been crafted over time to populate the financial world were not enough, further strategic tools may be created for agriculture, provided that the process under investigation is far from being exhausted. A supporting argument leads to consider the potential for weather derivatives in our new, climate-changed world: they started to be traded in the United States at the end of the nineties, in an attempt at devising new ways to manage – and, in particular, to hedge – weather risks; direct exposure to them can involve as many as one million firms estimated in agriculture, forestry, and fishing in Italy (PACELLI V., 2008).

In these market segments hedging may also be pursued by making recourse to catastrophe (briefly, cat) bonds, since they allow to transfer the risk of being affected by natural disasters to investors, who may finally bear the resulting losses, if specific trigger conditions are met. No question that the introduction of these bond issues sounds reassuring, but their high degree of sophistication prevents most of the agribusiness from adopting them; anyhow, not even private equity and venture capital have been as widely accepted as it could be expected in agriculture, in spite of the efforts undertaken to promote these financial tools that are designed to provide financial support to innovative small enterprises showing promise of job creation, economic growth, and international competitiveness.

The role of micro-finance

The unsatisfactory proportion of equity to debt financing should fuel feelings of pessimism, since indebted companies' vulnerability would rather persuade to strengthen their capital base and the same conclusion must be drawn by discussing the issues concerning their credit rating. Against this theoretical background, there are reasons to believe that benefits can be more easily reaped by resorting to micro-credit in the agribusiness, featuring a productive structure that is mostly built upon small firms, relatively closed to outside investment: while the recent financial crisis has led to the tightening of credit standards, above all by the largest banking groups (Bank of Italy, 2010), the recourse to financial institutions involved with micro-credit has been taken into increasing consideration as a part of the exit strategy; this trend is likely to continue and eventually become more marked, since the difficulties to access credit remain substantial compared to the years preceding the crisis.

In fact, micro-credit allows to borrow a smaller amount of money than the loan size usually offered by commercial banks, which may help companies to survive and hopefully grow, despite being denied access to traditional banking and related services, mainly due to the collateral aspect of loan requests. However, the advantages associated with micro-credit cannot be thoroughly grasped if its description is conditioned upon its smaller size than traditional bank loans: new institutions specializing in this market segment have contributed to its success by developing innovative distribution channels and new ways of delivering loans can be included within the concept of financial innovation, regardless of their amount; of course, *product innovation* does not tell the whole story, because *product* is only one of the *four Ps* accounted for by conventional studies about the marketing mix (MCCARTHY E. J., 1981), the other variables being *promotion* and *price*, besides *place*.

Furthermore, micro-credit can be seen as a sub-set of micro-finance, encompassing micro-lease and micro-equity financing, as well as micro-insurance policies and even micro-deposits, to the benefit of the agribusiness as of any other productive sector. To make these financial services far more attractive, they perform a social role that adds to the functions historically attributed to the banking system and leads to evoke the concept of *ethical finance*: its distinctive trait has to do with social responsibility issues, so far away from the profit maximization goals that theorists have recommended and entrepreneurs

have pursued for decades, thus postponing stakeholders' to stockholders' welfare; this point can be stressed by arguing that micro-finance calls for attention as an alternative to both traditional banking and illegal practices, such as usury.

Some strategic tools

The role that micro-finance is likely to play may be unfortunately minimized if it is confined to the underdeveloped environment in which Nobel prize Muhammad Yunus made initially recourse to this financial tool, in order to bring livelihood opportunities to the doorsteps of poor people. Indeed, micro-finance has proven useful elsewhere and its specific features make it a strategic way out when it comes to recover after a natural disaster: if this is the case, severe though basic financial needs, requiring a huge amount of money overall, dramatically surface all together and all at a sudden in different market segments; among and across them, special consideration has to be devoted to family-owned small companies that abound in agriculture and represent a unique category of firms for mixing up the characteristics of enterprises and households (CUCCULELLI M., MICUCCI G., 2008).

Similar comments, suggesting an unconditioned attitude, apply to institutional programmes based upon new financial engineering instruments, that can be usefully resorted to in agriculture, not necessarily in an underdeveloped environment or in an impacted area. The set of these instruments includes JEREMIE (Joint European Resources for Micro to Medium Enterprises), a joint initiative of the European Commission and the European Investment Fund with the European Investment Bank, aimed at improving access to finance for medium, small, and micro enterprises, in particular through the supply of micro-credit, venture capital, guarantees, and other forms of innovative financing; announced in 2005, this programme is designed to allow managing authorities to use some of their Structural Funds allocations to invest in revolving funds – rather than once-off grant financing – and so encourage recyclable forms of assistance, while discouraging an exclusive reliance on grants.

Public-private partnership innovative models, such as JEREMIE, pave the way for an even wider range of strategic tools that financial management in agriculture can usefully resort to. The underlying *join for change* philosophy may convey benefits that would be out of reach to firms on a case by case basis, since each of them alone could not take advantage of existing economies of scale to the same extent: for instance, the increasing role played by mutual guarantee institutions gives ground for optimism because of the widely felt difficulty of gaining access to small business finance (COLUMBA F., GAMBACORTA L., MISTRULLI P. E., 2010); the opportunity to issue district bonds acts as a reinforcement, with agriculture standing in a prominent position, due to the growing number of agrifood and rural districts.

RESULTS

Looking at the financial arena as a huge laboratory, with both physical and virtual features, there are many success stories that experimental studies have resulted in and some interesting case studies involve the primary sector; in an effort to choose the ones that most deserve consideration, it seems convenient to share the fruitful – though burdensome – experience made in the Abruzzo region, in Central Italy, in the aftermath of the earthquake that devastated L'Aquila and its environs on April 6, 2009 (EARTHQUAKE ENGINEERING RESEARCH INSTITUTE, 2009). Under the critical circumstances that can be easily imagined, a positive sentiment has been brought about by a couple of innovative solutions that fall

within the concept of *ethical finance* and that may prove beneficial to the agribusiness in that area.

On one hand, micro-finance has been emphasized by a project known as *Microcredit for Abruzzo*, that was developed by Consorzio Etimos and presented on July 22, 2010. This programme has been arranged so as to draw upon donations managed by the Italian Department of Civil Protection and to profit by the cooperation offered by several partners; they include a number of local banks, mostly mutual banks representing a category of banking intermediaries that traditionally provide financial services for agriculture.

On the other hand, right after the earthquake, a generous contribution to the University of L'Aquila was announced by Parmalat S.p.A., a global player active in milk and diary products and fruit-based beverages, with one third of the money donated by the company's employees: the grant was intended to be used for a single project, tied to the donor's multinational image and in fact allowed to create a micro-biological laboratory for both research and teaching purposes, tailored to the field of interest of the contributing firm; further activities could be eventually carried out in cooperation with local agricultural firms so as to support their recovery. Despite the difficulty of finding adequate premises, due to the pervasiveness of damage on campus, the *Parmalat Lab* was opened on July 15, 2010 and a scholarship was additional offered to cover its operating expenses during the first year.

CONCLUSIONS

Lessons learned encompass some conclusions about the relevant role that can be played by Universities, especially if they are located in an impacted area, and by their cooperative efforts, such as the ones jointly undertaken by the University of L'Aquila and Louisiana State University and Agricultural & Mechanical College (LSU) in Baton Rouge (LA, USA) on *redevelopment after a natural disaster*, a program sponsored by the US State Department. To make knowledge and expertise spread, as the academic mission implies, special attention can be drawn to the *mobile classroom* that has been set up by the Louisiana Business & Technology Center, an integral part of the E. J. Ourso College of Business at LSU: it is a converted semi-trailer that can be utilized also as a 30-seat *business incubator on wheels* to reach the unserved communities in rural Louisiana and encourage to seek further assistance; thanks to this entrepreneurial program, intensive business counselling has been provided, first of all to farmers in some of the areas most severely impacted by Hurricane Katrina, which originated an extensive need to educate agricultural firms on various recovery programs, loans, grants, and tax incentives.

The evidence built up over there leaves no doubt that financial innovation can help to upgrade financial management and to eventually benefit from greater access to credit in agriculture, like in all other industries. In fact, money should fully display its potential as an input, as important as any other one, even in this most traditional market segment: useful insights can be gained by assessing the leverage factor, that is defined as the ratio of total debt to total assets or total value of the firm; leverage, if used successfully, increases the returns to the owner(s) of the firm whereas, if unsuccessful, can result in inability to pay fixed charge obligations and, ultimately, in difficulties leading to financial reorganization or bankruptcy.

Further issues that deserve consideration have to do with credit rating, provided that a well managed firm from the financial viewpoint could expect to be better rated and hence to pay a relatively lower cost of capital. To sum up, new strategic tools come into being

daily in the financial arena that are likely to speed up the flight to quality in agriculture, though the hardest task is to make aware of them the multitude of small enterprises prevailing in this market segment: within this framework, even a change in the *place* factor of the marketing mix historically developed by banks can fit into the concept of financial innovation, as shown by the recourse to the *classroom on wheels*; the ambitious results achieved by its use do not only give satisfaction for international interest, in line with the more and more widely accepted *glocal* perspective, but also sound like an invitation to replicate them by adopting this case study as a contribution to foster long term, sustainable growth in agriculture.

REFERENCES

BANK FOR INTERNATIONAL SETTLEMENTS, BASEL COMMITTEE ON BANKING SUPERVISION (2004): "Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework", Basel, Switzerland, June

BANK OF ITALY (2010): "Annual Report – Ordinary Meeting of Shareholders – Abridged Report", Rome, Italy, May 31, p. 126

CARANZA C., COTTARELLI C. (1986): "Financial Innovation in Italy: a Lopsided Process", Temi di discussione nr. 64, Banca d'Italia, Rome, Italy, p. 5

COLUMBA F., GAMBACORTA L., MISTRULLI P. E. (2010): "Mutual Guarantee Institutions and Small Business Finance", in "Business Models in Banking: Is There a Best Practice? – Proceedings of the 2009 Banking Conference", Università Bocconi, Milan, Italy, p. 151

CUCCULELLI M., MICUCCI G. (2008), "Family Succession and Firm Performance: Evidence from Italian Family Firms", Temi di discussione nr. 680, Banca d'Italia, Rome, Italy, p. 3

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE (2009): "Learning from Earthquakes", Special Earthquake Report, June, Oakland (CA), USA

FORESTIERI G., MOTTURA P. (2005): "Il sistema finanziario", Egea, Milan, Italy, p. 2

MCCARTHY E. J. (1981): Basic Marketing, Irwin, Homewood (IL), USA, p. 42

MISHKIN F. S., EAKINS S. G. (2009): "Financial Markets and Institutions", Pearson Prentice Hall, Boston (MA), USA, p. 9

PACELLI V. (2008): "Weather risk management: analisi della domanda e dell'offerta di strumenti finanziari", in DELL'ATTI S. (ed.): "La finanza a servizio del comparto agroalimentare", Edizioni Scientifiche Italiane, Naples, Italy, p. 172.

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INFLUENCE OF SOMATIC CELL COUNT IN RAW MILK ON CHEESE PRODUCTION

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ABSTRACT

The purpose of this study is to determine the qualitative and quantitative changes of milk components due to the increased number of somatic cells and their influence on cheese production. During the study milk is categorized in three categories depending on the number of somatic cells.

The average number of somatic cells in milk from I category is 444.780/ml, II category 825.560/ml and in III category 1.242.220/ml.

The average contents of milk: fat, proteins, lactose, dry matter, casein and whey proteins in milk from I category is 4,2%, 3,3%, 4,7%, 12,1%, 2,9%, 0,9%, respectively. In II category 4,1%, 3,2%, 4,3%, 11,6%, 2,7%, 1,0%, respectively, and 4,0%, 3,1%, 4,0%, 11,1%, 2,4%, 1,2%, respectively in milk from III category.

The pH value of milk in I, II and III category is 6,627, 6,799 and 6,897, respectively.

There is a positive correlation in all three milk categories between somatic cell count and the whey proteins, while negative correlating dependency was found between the other chemical parameters and somatic cell count.

Key words: quality, milk, chemical components, somatic cells, cheese.

INTRODUCTION

The quality of milk intended for processing is determined by its physical-chemical and hygienic properties. A basic indicator of milk hygienic quality is the number of somatic cells, which are passing through the normal secretor process of the milk either from blood or from the epithelium, as normal biological structural elements.

Somatic cells increase when intramammary bacterial infection is present which causes change in milk secretion followed by qualitative and quantitative milk changes. These changes generally decrease the content of milk fat, lactose and casein and increase whey proteins.

The alterations in the physical and chemical properties of the milk are in correlation with the number of somatic cells (Katic and Stojanovic, 1998). According to (Srbinoska, 2007) the variation of the composition and the properties of raw milk affect certain technological operations in the processing of milk which affect the composition, properties, quality and yield of dairy products.

MATERIAL AND METHOD OF WORK

The cow milk used for the purpose of the research was from farms from the region of Kicevo. Analysis of the physical and chemical composition and somatic cell count was carried out on the samples of the bulk milk.

The analysis of the chemical composition of the milk means determining milk fat content, proteins, lactose and dry matter using an infrared analyzer Milcoscan in accordance with the IDF 141C:2000 standard, while the determining of the casein content

in percentage and the whey proteins is done by using the Kjeldahl method in accordance with the AOAS, 1995 standard.

The pH value was measured with a pH meter- Metller Toledo.

The cell count was determined with Fossomatic 5000 and milk-enumeration of somatic cells was done according to ISO 13366/2:2006 standard. The working principle of Fossomatic 5000 consists of staining and electronic counting of somatic cells. According to SCC milk is categorized in three categories:

1. I Category milk with up to 600.000/ml somatic cells,
2. II Category milk from 600.000 to 100.000/ml somatic cells,
3. III Category milk with more than 100.000/ml somatic cells.

RESULTS AND DISCUSSION

The results in Table 1 show that the average somatic cell count in the first category milk is 444.780 (min. 339.000 up to max. 586.000), in the second category 825.560 (min. 690.000 up to max. 972.000) and in the third category 1.242.220 (max. 1.172.000 up to max. 1.306.000).

Table 1. Average number of somatic cells in category I, II, III

Indicators	n	$\bar{x}$	S_d	min	max	Cv (%)
I category milk	9	444.780	84,735	339.000	586.000	19,051
II category milk	9	825.560	89,208	690.000	972.000	10,806
III category milk	9	1.242.220	47,232	1.172.000	1.306.000	3,802

Table 2. Average value of the chemical composition of the milk from I, II, III category

Milk category	n	Fat	Protein	Casein	Whey proteins	Lactose	Dry matter
I	9	4,206	3,268	2,910	0,8610	4,723	12,197
II	9	4,106	3,192	2,665	0,9680	4,349	11,647
III	9	3,989	3,139	2,386	1,1820	3,964	11,092

The results in Table 2 indicate certain variations in the chemical composition among the three categories of milk, which are in correlation with the number of somatic cells. The average content of milk fat in I category milk is 4,206%, in the II category 4,106% and in the third category 3,989%. It can be noticed that certain decrease of the content of milk fat occurs with the increase of the number of somatic cells of the milk.

The average content of protein in the first category milk is 3,268%, in the second 3,192% and in the third 3,139%. The results show no significant variations. The increase of SCC in milk does not significantly affect the total protein content (Katić et al., 1994).

The results in Table 2 indicate significant decrease of the content of the casein- the main milk protein. In the 1st category milk it is 2,910%, in the 2nd 2,665% and the decrease of the content of the casein is significantly evident in the 3rd where SCC is the highest 2,386%. The difference in the percentage of casein among the three categories are

significant at the level of (p<0, 01). The decrease is a result of the reduction of the synthesis and secretion of the protolithic protein called plasmin.

The value of the whey proteins increases in all three categories. In the 1st category it is 0,8610%, in the 2nd 0,9680% and the value of the whey proteins in the 3rd category is 1, 1820%. Significant differences in the content of the whey proteins was observed among the three categories of milk (p<0, 01). The increase of the whey proteins as a result of the change of the vascular permeability decreases the thermo stability of the milk (Jones and Bailey, 1998).

The obtained results show great variation of the content of the lactose among the three categories of milk. The average content of lactose is decreased as the SCC in milk is increased. In 1st category of milk it is 4,723%, in 2nd 4,349% and in the third category the average content of lactose is 3,964%. Highly significant differences were observed in the content of lactose (p<0, 01). According to Rupic and Havranek (2003), the physiological minimum is 4,55% and any decrease of it refers to increase of somatic cell count in the milk.

The obtained results show a decrease of the content of dry matter in all three categories of milk, which is in accordance with the decrease of the content of the milk components. The average content of dry matter in the 1st category milk is 12,197%, in the 2nd 11,647% and the least content of dry matter in the third category is 11,092% (min.10, 91% up to max.11, 25%).

Table 3. Yield of the cheeses from I, II, III category

	I category			II category			III category		
Weighing of the cheese	$\bar{x}$	S_d	Cv (%)	$\bar{x}$	S_d	Cv (%)	$\bar{x}$	S_d	Cv (%)
1st day	20,350 [a]	0.356	0,175	19,486	0,270	1,388	18,790	0,115	0,613
15th day	19,123 [b]	0,095	0,495	17,976	0,437	2,432	17,096	0,257	1,506
30th day	17,643 [c]	0,201	1,138	15,893	0,028	0,180	14,787	0,119	0,805

* The differences of the values with different superscript letters are significant at the level:
a:b statistical significance at the level of (p<0, 01)
b:c statistical significance at the level of (p<0, 01)
a:c statistical significance at the level of (p<0, 05)

Table 3 shows the yield of the three categories of cheeses. The measuring of the yield of the cheese was carried out three times during ripening period as follows: d 1 immediately after cutting it, d 15 and d 30 of the ripening of the cheese. The results obtained lead to the conclusion that the yield of first category milk the first day of ripening is 20,350 kg, of the second category 19,486 kg and of the third category 18,790 kg. The coefficient of variation in the cheese from the first category is (Cv=0,175), the second (Cv=1,388) and the third (Cv=0,613).

On the fifteenth day of ripening the yield of the 1st category is 19,123 kg, the second category 17,976 kg and the third category 17,096 kg. The standard deviation in the first category is (Sd=0,095), in the second category (Sd=0,437) and in the third category (Sd=0,257). The coefficient of variation of the cheese from the first category is (Cv=0,495), from the second category (Cv=2,432) and from the third category (Cv=1,506).

On the thirtieth day of ripening the rendement of the cheese from the first category is 17,643 kg, from the second 15,893 kg and from the third 14,787 kg. The standard deviation in the cheese from the first category is (Sd=0,201), from the second category (Sd=0,028) and from the third (Sd=0,119). The coefficient of variation of the cheese from the first

category is (Cv=1,138), from the second category (Cv=0,180) and from the third category (Cv=0,805).

The rendement difference in the three categories of cheese according to statistical data indicates significant change on the level of ($p<0,05$).

The rendement and the abatement are a key element for an economical cheese production. According to Kapac- Parkaceva (1988) several factors affect the rendement of cheese such as the quality and chemical composition of the milk, especially the fat and casein concentration, the technological process and the way the cheese is stored.

Table 4. Total abatement ($\bar{x}$) of the cheese during ripening

Category	Total abatement	
	kg	%
I category	$2,707^a$	13,30
II category	$3,593^b$	18,44
III category	$4,003^c$	21,30

* The differences of the values with different superscript letters are significant at the level:
a:b statistical significance at the level of ($p<0,01$)
b:c statistical significance at the level of ($p<0,01$)
a:c statistical significance at the level of ($p<0,05$)

As can be seen from the data in Table 4 of our study the cheese from the three categories after thirty days of ripening has different rendement which is lower in the categories with higher somatic cell count. According to the results the rendement of the cheese of the first category after ripening was 17,643 kg, the rendement of the second category 15,893 kg and the rendement of the cheese from the third category was 14,787 kg. The difference of the rendement among the three categories of cheese are significant at a level of ($p<0,05$).

Taking in consideration that the cheese from the three categories is produced under the same technological conditions (same quantity of milk, same pasteurization and coagulation temperature of the milk, curd processing, pressing, salting/brining and ripening of the cheese), it can be said that the difference in the rendement of cheese is due to the change of the milk composition (change of the quality of the milk) which ultimately affects the end goal - the rendement of cheese.

Mihailov (2005), examined the influence of somatic cells on the rendement of white soft cheese and his findings were as follows: the rendement of cheese from milk with 100.000 somatic cells is 18,20 kg, the rendement of cheese from milk with 800.000 ml somatic cells is 17,77 kg, and the rendement of cheese from milk with 1.300.000 somatic cells is 17,48 kg. Bruhn (1983) researched the influence of the somatic cells on the rendement of Cheddar cheese and came to the following findings: he rendement of cheese obtained from 100 liters of milk with 240.000 somatic cell count was 9,748 kg, the rendement of cheese obtained from milk with 496.000 somatic cell count was 9,686 kg, and the rendement of cheese obtained from milk with 640.000 somatic cell count was 9,430 kg. The results shows that the cheese made of milk with higher SCC have a lower rendement. The research carried out at the Cornell University for the purpose of establishing the quantitative ratio between the increase of the somatic cells and the rendement of cheddar cheese concluded that the increase of somatic cells of 100.000/ml dramatically reduces the rendement by 1%, and the increase of somatic cells of 100.000-1.300.000 lowers the rendement by another 1-2% (Dairy center News, 1991).

One of the aims of our research was determining the abatement in the ripening process. The results obtained show that the total abatement after the ripening period of 30

days in the cheese from the first category is 2,707 kg or (13,30%), in the second category the wastage rate is 3.593 kg or (18.44%). The abatement in the third category cheese is the highest at 4,003 kg or (21,30%). The differences in the total abatement in the three categories are significant at a level of ($p<0,01$).

The abatement was determined even in the phases of the ripening of the cheese, i.e. the abatement that appears in 1-15 day and the abatement of the cheese that appears in 15-30 day. The difference in the abatement between 1-15 day and 15-30 day in the first cheese category is at the significant level of ($p<0,05$), and in the second and third category the abatement between 1-15 day and 15-30 day is significant at a level of ($p<0,01$).

Many authors, in the available literature, conclude from the data that the number of somatic cells affects the rendement of cheese, but only few are with precise indicators. The infection of the mammary gland results in both a decrease of milk production in the cells of the secretory epithelium and quantitative and qualitative changes in the composition of the milk followed by a decrease in the content of the casein, lactose, milk fat and an increase of the composition of the whey proteins and enzymes. According to Auldist et al. (1996), the change in the composition of the milk with increased somatic cells has a negative effect on its suitability for cheese processing, and is the result of the influence of the enzymes on the proteins and fat. The negative effect of higher levels of somatic cells in the milk intended for cheese making means decreased hardness of the coagulum and a loss of a substantial amount of casein and fat in the whey, whereas the increase of the content of the whey proteins results in a decrease of the thermostability of the milk. The change in the ratio of the casein fractions occurring in the milk with higher somatic cell count results in a decrease of the rendement, altered sensory properties, decreased shelf life due to higher water retention and low profitability during the processing of the milk into cheese. According to Mazal (2007), the cheese made of milk with high levels of SCC contains more water, and during the ripening process there is higher protheolytic activity endangering the typical sensory quality of the cheese.

CONCLUSION

The results of this trial indicate that there are significant differences in the physico-chemical content of the three categories of milk, i.e. the increase of SCC in the milk alters certain milk components, especially decreasing the percentage of lactose ant the main milk protein-casein and increasing the content of the whey proteins. The alterations in the chemical content are more noticeable in the second category milk and they are significant in the third category milk where the average SCC is 1.242.220. In this milk category the content of lactose is pretty low 3,964%, the casein 2,386%, whereas the whey proteins have the highest value 1,1820%. The alteration of the chemical content and properties of the milk due to high SCC, during its processing leads to lower dairy quality and rendement, and thus brings out economic losses in the dairy industry.

The rendement of cheese in the three categories after the ripening of 30 days is as follows: cheese from I category milk 17,643kg, cheese from II category milk 15,893, and the rendement from III category 14,787kg. Although the cheese was manufactured using the same technological processes the rendement in cheese from II and III category decreases.

We can conclude that nevertheless the cheese is made under the same technological conditions the rendement is lower in the cheese made from the milk from category II and III along with the proliferation of somatic cells and their impact to change in milk components.

The total abatement (mass loss) that occurs in all three categories during the ripening period from 1 to 30 days is: cheese obtained from category I milk 13,30%, cheese from category II milk 18,44%. The abatement in the cheese produced from category III milk is the highest at 21,30 %.

The differences occurring in the total abatement among all three categories are significant at level ($p<0,01$).

REFERENCE

1. AULDIST, M. J., COATS S., SUTHERLAND B J., MAYES J. J., MCDOWELL G. H. AND ROGERS G. L. (1996). Effects of somatic cell count and stage of lactation on raw milk composition and the yield and quality of cheddar cheese. J. of Dairy Res. 63: 269.
2. HARMON, R.J. (1994). Physiology of mastitis and factors affecting somatic cell count. Journal of dairy science 77.
3. JONES, G.M, AND J.R. BAILEY. (1998). Mastitis Control in Heifers and First Lactation. Virginia Cooperative Extension, Publication Number: 404/281.
4. KAPAC PARKACEVA N. (1988). Tehnologija na prerabotkite od mleko, Agricultural Faculty, Skopje
5. KATIĆ V., TAYEB EL HUDA, BABIĆ, LJ., POPOVIĆ, J. (1994). Uticaj mastitisa na kvalitet mleka. Veterinarski glasnik, 271-276.
6. KATIĆ V., STOJANOVIĆ L.: (1998) : Uticaj mastitisa na higijensku ispravnost mleka. Jugoslovenski mlekarski simpozijum „Kvalitet mleka i fermentisanih proizvoda", Zlatibor. 5-9.
7. MAZAL, G., P. C. B. VIANNA, M. V. SANTOS, AND M. L. GIGANTE. (2007). Effect of somatic cell count on Prato cheese composition. J. Dairy Sci. 90:630–636.
8. RUPIĆ, V., HAVRANEK, J.: (2003): Mlijeko od farme do mljekare. Hrvatska mljekarska udruga. Zagreb.
9. SRBINOVSKA S.: (2007): Higiena i kvalitet mleka u Republici Makedoniji u saglasnosti legislativom Savremena Poljoprivreda vol.56, 5 str.61-68, Novi Sad.
10. SKEIE, S. (2007) Characteristics in milk influencing the cheese yield and cheese quality. Journal of Animal and Feed Sciences 16, suppl 1. 130-142

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STAGE OF IMPLEMENTATION OF THE NATIONAL RURAL DEVELOPMENT PROGRAMME IN ROMANIA THREE YEARS AFTER THE ADHESION

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ABSTRACT – Stage of implementation of the National Rural Development Programme in Romania three years after the adhesion
The financing mechanism of CAP pillar II – Rural development has suffered, along time, significant changes, determined by the need for improvement and also by the experience achieved in this field by the European organisms and the member countries. The attaining of a rate as big as possible of the capacity of absorbing European funds represents a real „challenge", especially for the new member states. Three years after the adhesion, unfortunately Romania has not succeeded in carrying out adequate fund absorption for rural development; at the end of 2010, the absorption degree recorded was only 17.7% and the contracting degree was only 34%.

Keywords: National Rural Development Programme (NRDP), pillar II, public funds, projects

INTRODUCTION

The rural development policy fills out and accompanies the market policy and aims at the consolidation and diversification of rural economy. This policy relies on the integrated multi-sectorial approach of the rural area.
The financing mechanism of the common rural development program has suffered, during time, significant changes, culminating with the Cap reform from 2003, with references for the programming period 2007-2013.
The European Commission stipulations that reform the rural development policies for 2007-2013 include, beside several other aspects, the reorganization of financing, by dividing the **European Agricultural Guidance and Guarantee Fund (EAGGF)** into **European Agricultural Guarantee Fund (EAGF)**, for measures supporting the common market organizations, and **European Agricultural Fund for Rural Development (EAFRD)**, for rural development measures. This was an attempt to solve the essential problem of individualization of the financing resources for the two CAP pillars: **agriculture** and **rural development**. At the same time, three main objectives in the field of rural development were reformulated, namely:

- competitivity improvement in the agricultural and forestry sectors;
- environmental protection and rural landscape improvement;
- life quality improvement, by diversifying the economic activities in the rural area.

These desiderata have become foreground axes of the rural development programs.
The new rural development policy, according to the EU commissioner for agriculture and rural development, Mariann Fischer-Boel, is *„more extended, simpler and better, because it answers the requirements of the European citizens"*.

The defining elements of the rural policy future are:

1. a single programming and financing instrument – European Agricultural Fund for Rural Development;
2. a new strategic approach for rural development, with clear concentration on the EU priorities;
3. refreshment of control, assessment and communication and a more accurate responsibility division between the member states and the Commission;
4. a stronger „bottom-up" approach. Member states, regions and the local groups of action will have the opportunity to express their opinions regarding the relationship between these programs and their local needs.

MATERIAL AND METHOD

The analysis of the NRDP implementation in Romania relies on the analysis of the projects applied for financing until the end of 2010, of the projects declared to be eligible, of the ones selected for financing and of the projects contracted or even completed. Projects analysis was performed from the viewpoint of their value, as well. These data were provided by the Minister of Agriculture and Rural Development and processed by the authors of this work in order to draw conclusions.

To admit one project for financing, it must pass several examinations for:

a) conformity;
b) eligibility;
c) selection.

The conformity step supposes the checking of the application for financing, if it was correctly filled in, if it includes all the correct technical and managerial annexes, in two copies and if the application is presented in electronic and printed format. The projects applied and declared to be corresponding will enter the step of eligibility assessment.

The assessment, more exactly the **checking of project eligibility**, involves the checking of applicant's eligibility, of the eligibility and selection criteria specific to the investment type, of the project budget, of the study of feasibility and of all the documents attached.

Successive to this step, the projects declared eligible will be submitted to a **selection system**, and each project will be qualified in concordance with the selection criteria presented in the Applicant's Guide, afferent to each type of investment separately. Only the projects obtaining points over the minimal stipulated limit will be admitted for financing. The next step is represented by the signing of the financing contract.

RESULTS

In the new CAP reform stage, the improvement of the rural development policy has become a priority of maximal importance for European Union. Under the conditions provided by EU extension to 27 member states, the rural development policy as part of the regional integration policy play an important role in the strengthening of the economic and social cohesion.

The rural development policy for 2007-2013 is synthesized in three axes, plus the axe LEADER; each axe includes a set of measures conceived to provide the accomplishment of the objectives proposed.

Once admitted the National Program for Rural Development 2007-2013 by the European Commission (February 2008), the first session of applications for projects belonging to the measures 121 *„Farm modernisation"*, 123 *„Adding value to agricultural and forestry products"*, 322 *„Village renewal and development"* was opened in March.
The session of May opened financing for two governmental support schemes, for IMMs processing agricultural products, afferent to the measure 123 – *Governmental Support Scheme XS 13/123 A/2008*, for agricultural products processing and *XS 28/123 B/2008*, for forestry products processing.
The session of September-October opened financing for the measures 312 *„Support for the creation and development of micro-enterprises"* and 313 *„Encouragement of tourism activities"*.
Other three new measures have been implemented since 3 December 2008, with the opening of the first application session for the measures 112 *„Setting up young farmers"*, 141 *„Supporting semi-subsistence farms undergoing restructuring"* and 142 *„Setting up of producer groups"*.
During the session from 15 September-22 October 2009, the measure 431 *„Running the local action group, skills acquisition, animation"* was launched, with the submeasure 431.1 „Building of public-private partnerships", phase 3 „Financial support for the preparation of LAGs".

Table 1. Measures of rural development with opened financing (31.12.2010)

Measure	Financial participation, public funds (mil. Euro)			Beginning of implementation
	Total	EU	RO	
121 – Farm modernisation	991,8	793,4	198,4	March 2008
123 – Adding value to agricultural and forestry products	1071,1	856,9	214,2	March 2008
322 – Village renewal and development	1546,1	1236,9	309,2	March 2008
Governmental support scheme XS 13/123	118,1	94,5	23,6	May 2008
Governmental support scheme XS 28/123	110,0	88,0	22,0	May 2008
312 – Support for the creation and development of micro-enterprises	383,4	306,7	76,7	September 2008
313 – Encouragement of tourism activities	544,2	435,4	108,8	September 2008
112 – Setting up young farmers	337,2	269,8	67,4	December 2008
141 – Supporting semi-subsistence farms undergoing restructuring	476,1	380,9	95,2	December 2008
142 – Setting up of producer groups	138,8	111,0	27,8	December 2008
431.1 – Building of public-private partnerships, Phase 3	9,8	7,8	2,0	September 2009
125 – Improving and developing infrastructure related to the development and adaptation of agriculture and forestry	483,2	386,6	96,6	March 2010
Governmental support scheme N578/123	200,0	160,0	40,0	July 2010
221 – First afforestration of agricultural land	229,3	183,4	45,9	October 2010

The measure 125 *„Improving and developing infrastructure related to development and adaptation of agriculture and forestry"* was opened for financing beginning with the session of projects from March 2010; the implementation of the State aid scheme N578 *„Stimulation of Regional Development by Investments for Agricultural and Forestry Products Processing in order to Obtain Non-Agricultural Products"*, afferent to the measure 123, is supposed to be applied in July.

Another measure for rural development was implemented in Romania in February 2011, namely the measure 221 *„First afforestation of agricultural land"*.
Of the 27 measures for rural development selected by Romania from the common environment, the country implemented 14 measures until the end of 2010 (table 1).

Table 2. Situation of projects applied within NRDP until 31.12.2010

- Thousand euro

Measure		Projects applied		Projects selected		Financing contracts/decisions completed		Payments done
		No.	Public value	No.	Public value	No.	Public value	Public value
112		6572	136720	4567	95840	2799	58979	35542
121		5545	2121051	1845	725476	1585	568567	228186
123		913	972257	556	580960	369	362031	72173
Scheme XS 13/M123		247	113706	215	101626	179	78404	28829
Scheme XS 28/M123		177	78897	157	67451	134	59285	18118
Scheme N578/M123		167	125825	-	-	-	-	-
125		870	922897	141	165674	123	141434	-
141		31757	238177	18413	138097	15686	117645	24476
142	NRDP	17	2440	15	2235	14	2215	217
	Transferred from SAPARD	-	-	-	-	3	30	-
312		3980	543861	1382	204327	1338	196677	41503
313		1401	238968	634	115517	583	102731	6809
322		3039	7429244	610	1620540	602	1522969	155483
431.1	Phase 3	112	4920	111	4827	104	4340	3134
	Phases 1+2					8	1704	1657
511						24	8428	5188
Guarantee schemes						2	220000	220000
211								146691
212								78853
214	NRDP							326552
	Transferred from SAPARD					1	5	-
221	NRDP	6	1787	-	-	-	-	-
	Transferred from SAPARD					3	7	-
611								395714
TOTAL		**54803**	**12930750**	**28646**	**3822570**	**23557**	**3445451**	**1789126**

Source: The Ministry of Agriculture and Rural Development
http://www.madr.ro/pages/dezvoltare_rurala/situatia-proiectelor-depuse-31.12.2010.pdf

During the 27 project sessions organized until the end of 2010, a total number of 54,803 projects were applied in the whole country, afferent to 14 measures; of these, 28,646 projects obtained the required points and were selected for financing, and 23,557 were completed with financing contracts or decisions.
The most of the projects were applied for the measure 141 *„Support of semi-subsistence agricultural farms"*. This measure aims at the increase of the volume of the production to be sold, in order to turn the semi-subsistence farms into economically-viable ones, respectively at the diversification of production according to market requirements and to the introduction of new products. The non-reimbursable public support is of 1500 euro/year/farm, for a 5-year period, if the farmer proves that the agricultural production

obtained after three years, destined for sale, increases with 20%, and that farm's economic dimension increases with minimum 3 ESU (Economic Size Unit).
The most of the biggest, important projects were applied for the measure 121 *„Modernization of the agricultural holdings"*; this situation was expected because of the big number of projects applied for the similar measure of the SAPARD programme.
We should mention the fact the measures belonging to AXE 2, namely M 211 *„Support for the disfavoured mountain area"*, M 212 *„Support for disfavoured areas, others than the mountain area"* and M 214 *„Agri-environment payments"* are measured administrated by the Agency of Payments and Intervention in Agriculture (APIA) and do not require the application of projects because the support is offered as direct payments to farmers.
The measure 511 *„Technical assistance"* includes funds allocated for the Agency of Payments for Rural Development and Fishery (APDRP), for projects of technical assistance that should support the process of technical and financial implementation of the National Rural Development Programme.
The measure 611 *„Direct complementary payments"* represents the sums transferred from rural development to Pillar I Agriculture, to complete the national sources of financing of the direct complementary payments offered the farmers.
The public financial allocation for NRDP 2007-2013 attains the sum of 10097 million euro, of which FEADR's contribution represents about 8124 million euro and the national contribution from the state budget represents 1973 million euro. Within this programme, 54,803 projects were applied until the 31st of December 2010, in total public value of approximately 13 milliard euro. Of these, 28,646 contracts were selected, in value of 3.8 milliard euros, and only 23,557 projects were contracted, representing about 3.4 milliard euros, meaning 1/3 of the total allocated. The absorption degree of rural development funds, calculated as report between the payments performed and the sum allocated, was of 17.7% at the end of 2010.
In 2008 (the first year of implementation of NRDP), the payment rate was rather reduced, and the effective implementation of projects started in the second half of the year; the first contracts were completed at the beginning of September 2008. In this viewpoint, the absorption degree of the financial allocation in 2008 was 1.36%.
In 2009, the absorption degree of the financial allocation was 6.77%, and at the end of 2010 it was 17.7%.
After the first two years of effective implementation (in 2008, the main activity was consisted of the application of projects and their evaluation), the contracting rate is approximately 34%.
Considering that the beneficiaries of this Programme, according to measure, must participate with their private co-financing part, and some of them present difficulties in the achievement of the necessary credits, there have also been several contract cancellations (about 230 projects).

CONCLUSIONS

The application of Common Agricultural Policy for Romania is supported by important financial resources, allocated from the common budget and from the national budget. The allocations for rural development measures from the EU budget attain the sum of 8124 million euro, much over the financial support level of the National Rural Development Programmes from other countries, and Romania's participation is 19.54%, respectively 1973 million euro. The public contribution (EU + Romania) for the support of rural development during 2007-2013 totals 10097 million euro, and if we also add the

private contribution of beneficiaries in the case of measures that require co-financing, we obtain the total sum of 13574 million euro. We should also mention that 625 million euro of this sum are designated for direct agricultural support and not for rural development, representing a fund transfer from Pillar 2 to Pillar 1, in order to complete the direct payments offered the farmers, with financing from the national budget.
The sum designated to rural area financing is a significant one; however an important problem we should insist on is related to the capacity of common fund absorption, doubled by the capacity of co-financing. The lack of transparency, reduced experience, insufficient information, bad project management, reduced possibility of providing the financial advance or the private contribution – all of these are aspects that might exert negative influence on the process of absorption of the funds destined for rural development.

REFERENCES

1. CATANĂ, AIDA (coord), 2007, Development of projects financed from Structural Funds for SMEs 2007-2013, Contaplus Publishing House, Ploiesti
2. FEHER, ANDREA, 2009, Financing of agriculture and rural development. Community Policies, Orizonturi Universitare Publishing House, Timisioara
3. OTIMAN, P.I. (coord.), 2006, Sustainable rural development in Romania, Publishing House of Romanian Academy, Bucuresti
4. Implementation and vision of Common Agricultural Policy. CAP in the 27 EU Member States, Council for the Rural Area, The Netherlands, 2008
5. Rural Development in the European Union, Statistical and Economic Information, Directorate-General for Agriculture and Rural Development, Report 2009 http://ec.europa.eu/agriculture/agrista/rurdev2009/RD_Report_2009.pdf
6. Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), Official Journal of the European Union, L. 277/21.10.2005
7. Council Regulation (EC) No 473/2009, Official Journal of the European Union, L. 144/09.06.2009
8.http://ec.europa.eu/budget/library/documents/multiannual_framework/2007_2013/tab_rural_devt_2007-2013.pdf - „EU support for Rural development 2007-2013"
9. http://www.madr.ro/pages/dezvoltare_rurala/situatia-proiectelor-depuse-31.12.2010.pdf - „The situation of the NRDP projects 31.12.2010", The Ministry of Agriculture and Rural Development of Romania
10. The National Rural Development Programme 2007-2013, enhanced version June 2010, The Ministry of Agriculture and Rural Development of Romania

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ISOLATION AND CHARACTERIZATION OF CARBENDAZIM-DEGRADING BACTERIA FROM AGRICULTURAL SOIL SAMPLES

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ABSTRACT - Isolation and characterization of carbendazim-degrading bacteria from agricultural soil samples.
The use of chemical pesticides in agriculture generates many ecological and human toxicological problems. One of the most frequently used fungicides is carbendazim, however, in spite of its importance, there are only a few reports dealing with its microbial degradation in the environment. It has high acute ecotoxicological effect, as well as a suspected endocrine disruptor potential, so its residues in food and feed are dangerous. Until now, single isolates of *Pseudomonas*, *Rhodococcus* and *Ralstonia* have been found to be able to degrade carbendazim. Among fungi, one isolate of *Alternaria alternata* and *Phanaerochete crysosporium* were described as good carbendazim degraders. Bacterial degradation pathways have been partially explored: the first step is the hydrolysis of the carbamate group, followed by a ring-fission in 2-aminobenzimidazole resulting 1,2-diaminobenzene. This compound is further metabolized via the beta-ketoadipic acid pathway. As part of our studies on pesticide biodegradation, new carbendazim-metabolizing bacteria were isolated from Hungarian agricultural soil samples. These degrader bacteria were isolated from soil samples by microbiological enrichment methods. The molecular analysis revealed that the best isolates belong to the *Variovorax paradoxus* species. The isolate 10/1 was able to use carbendazim as sole carbon and nitrogen source. The pH optimum and temperature optimum for growth were found to be pH 6.3 and 30 °C, respectively. This isolate seems to be an efficient tool for the bioremediation of carbendazim polluted agricultural soils.

Keywords: *Variovorax*, carbendazim, biodegradation

INTRODUCTION

The use of chemical pesticides in modern agriculture generates many ecological and human toxicological problems. One of the most frequently used agricultural fungicide both in Serbia and in Hungary is carbendazim (Fig. 1.). In spite of this, there are only few reports dealing with its microbial degradation. It has high acute ecotoxicological effect, as well as a suspected endocrine disruptor potential in human and animals, so its residues in food and feed are dangerous. Until now, single isolates of *Pseudomonas* (FUCHS and DE VRIES, 1978), *Rhodococcus* (HOLTMAN et al, 1997) and *Ralstonia* strain (GUI-SHAN ZHANG et al, 2005) proved to be able to degrade carbendazim. Taking into account fungi, one isolate of *Alternaria alternata* and *Phanaerochete crysosporium* described as good carbendazim degraders (SILVA et al, 1996: 1999). In case of bacterial degraders the degradation mechanism and pathway was also partially explored. In this process, at first the carbamate group is hydrolyzed to 2-amino-benzimidazole, which is further degraded by

ring fission leading to 1, 2-diamino-benzene. This intermedier is further metabolized via the beta-keto adipic acid pathway. As part of this, an investigation was made to isolate carbendazim-degrader bacteria from agricultural soil samples.

MATERIAL AND METHOD

Soil samples were collected from agricultural fields in Hungary, where carbendazim was regularly used. Isolation of carbendazim-degrading bacteria was carried out via the continuous enrichment culture method. Briefly: 5 g sample of soil was suspended in 50 ml sterilized NaCl solution 1.0 (g/l). From this suspension 0.1 ml was inoculated into the enrichment medium, (g/l): K_2HPO_4 1.0, $MgSO_4$ $7H_2O$ 1.0, NaCl 0.5, supplemented with carbendazim (200 mg/l). Carbendazim (purity: 94.6%) was firstly dissolved in 1 M hydrochloric acid at 20 mg/ml concentration. The pH of the medium was about 7.0 after the addition of carbendazim solution. The flasks were incubated in the dark at 20 °C on a rotary shaker at 200 rpm. After 14 days, dilution series were made from each culture and from these dilutions 50 µl aliquots were spreaded onto yeast extract glucose agar plates (YEG: (g/l) yeast extract 2.0, glucose 2.0, Bacto agar 18). Plates were desiccated and incubated for 3 days at 20 °C. The dominant colonies were picked up and tested for their carbendazim degrading ability.

The taxonomical positions of the isolates with best degrading ability were determined by partial sequencing the 16S ribosomal RNA genes. For PCR reaction standard conditions were applied with the following primers: Eub-341f 5'-CCTACGGGAGGC AGCAG-3' and UP-765r 5'-CTGTTTGCTCCCCACGCTTC-3'.

Carbendazim degrading abilities of the isolates were measured in enrichment medium supplemented with 50 mg/l carbendazim and 150 mg/l yeast extract. After incubation, samples from the cultures were diluted to twice fold with ethanol, centrifuged at 10 000 g for 3 minutes and the absorbance of the clear supernatants were determined in a spectrophotometer at 280 nm where both carbendazim and 2-amino-benzimidazole have strong absorbance. The degradation of carbendazim was correlated with the reduced absorbance values measured.

RESULTS

From the ten soil samples collected, eight different bacterium isolates were obtained after the enrichment step where carbendazim was the sole carbon and nitrogen source in the medium.

The carbendazim degrading abilities of these isolates are presented in *Table 1.*

Table 1. Carbendazim degrading abilities of different bacterial isolates obtained from Hungarian soil samples. Incubation time: 14 days.

Strain code	Species identity	Residual carbendazim (control 100%)
1/2	*Variovorax paradoxus*	73 %
6/2	*Acidovorax defluvii*	69 %
6/3	*A. delafieldii*	60 %
6/5	*Pseudomonas sp.*	64 %
6/8	*Microbacterium phyllosphaerae*	78 %
10/1	*V. paradoxus*	10 %
10/4	*Acidovorax sp.*	44 %
10/5	*Acidovorax sp.*	97 %

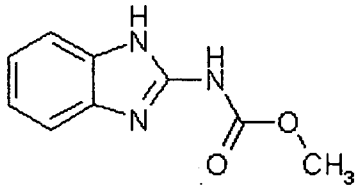

Figure 1. Structure of carbendazim

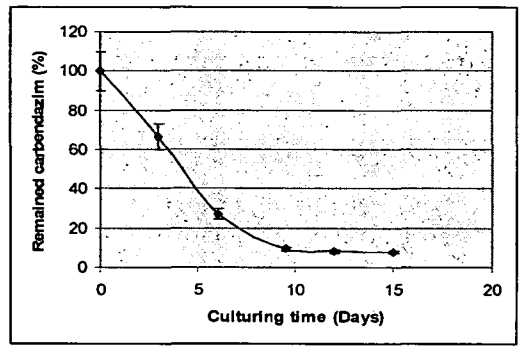

Figure 2. Degradation kinetics of carbendazim by *V. paradoxus* 10/1 isolate.

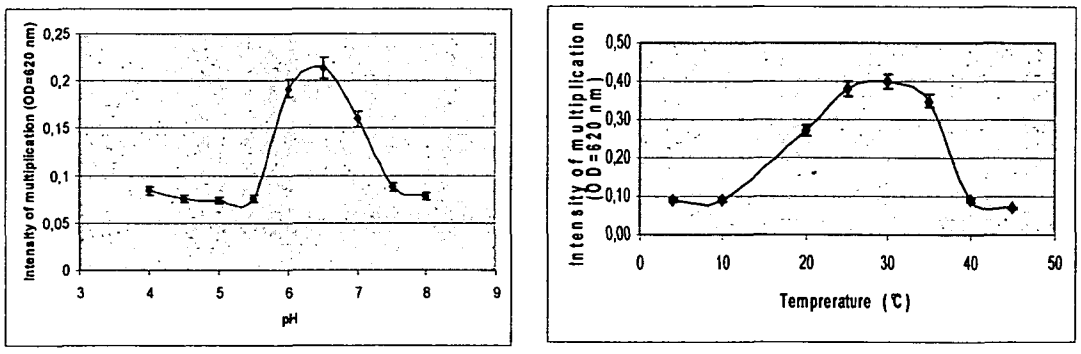

Figure 3. pH- and temperature-dependence of the growth of *V. paradoxus* 10/1 isolate.

After preliminary experiments, composition of the enrichment medium has been reformulated: it turned out that in the presence of NH_4Cl the bacterial isolates were unable to degrade carbendazim. Further investigations were carried out with the isolate 10/1,

which has the best degrading ability. A part of its 16S RNA gene was sequenced and analyzed: web-based similarity searches against the GenBank and Ribosomal Database Project databases revealed that 10/1 shared 100% identity with the 16S rDNA of strains of *V.* (formerly *Alcaligenes*) *paradoxus* (*Comamonadaceae*, WILLEMS et al, 1991). Our results show that *V. paradoxus* 10/1 was able to degrade 90% of carbendazim within ten days (*Fig. 2.*). The isolate was able to grow in ranges pH 5.5-7.5 and temperature 10-40 °C, respectively (*Fig. 3.*).

The carbon and nitrogen source utilization spectra of this bacterium were also investigated. From the tested 23 carbon sources, D-xylose, D-sorbitol, D-mannitol and some amino acids (L-leucine, L-izoleucine, L-proline, L-phenylalanine and L-tyrosine) supported its growth. In the presence of glucose, galactose and other common mono- and disaccharides, the growth of the strain was poor. From the compounds tested, urea, L-glutamine and L-asparagine (besides other L-amino acids) were the best nitrogen sources. *V. paradoxus* utilized NH_4Cl and $NaNO_3$ very poorly. In the carbendazim-degrading strains we detected highly active esterases in the periplasmic space or in the cytoplasm, but never in ferment broths. The same strains intensively used methylacetate and L-tyrosine methyl ester for growth (*Fig. 4.*). Probably these esterases are also able to hydrolyze the carbamyl-methyl ester group in carbendazim.

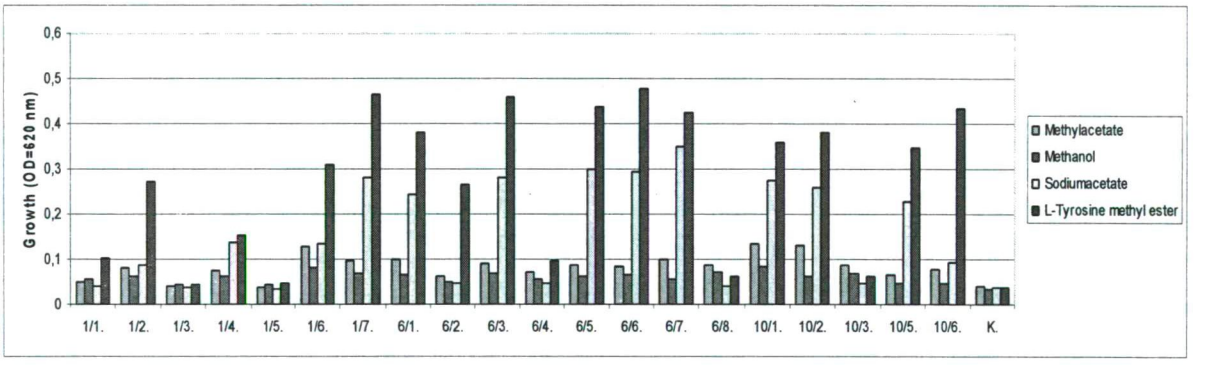

Figure 4. The use for growth of distinct esters by the bacterial strains isolated from carbendazim degrading communities.

CONCLUSIONS

Soil samples proved to be excellent sources of bacteria with carbendazim degrading ability. Key parameters of an efficient enrichment technique were optimized. It is proved that besides the ubiquitous soil bacteria *Ralstonia*, *Rhodococcus* and *Pseudomonas*, the *Variovorax* species also have great potential in the biodegradation of carbendazim. Until now only bacteria belonging to the genera *Pseudomonas*, *Rhodococcus* and *Ralstonia* were known as good carbendazim degraders (GUI-SHAN ZHANG et al, 2005). DEJONGHE et al. (2003) described *V. paradoxus* ability to degrade Linuron, a worldwide used herbicide. The molecular structure of Linuron has some common features with carbendazim: it contains an aliphatic carbamyl group and an aromatic ring. This suggests that some steps would be common in their degradation pathway in *V. paradoxus*.

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REFERENCES

DEJONGHE W., BERTELOOT E., GORIS J., BOON N., CRUL K., MAERTENS S., HÖFTE M., DE VOS P., VERSTRAETE W., TOP E. M. (2003): "Synergistic degradation of Linuron by a bacterial consortium and isolation of a single linuron-degrading *Variovorax* strain. Applied and Environmental Microbiology **69,** 1532-1541.

FUCHS A., DE VRIES F.W. (1978): "Bacterial breakdown of benomyl. I. Pure cultures." Antonie van Leeuwenhoek **44,** 283-292.

GUI-SHAN Z., XIAO-MING J., TIAN-FAN C., XIAO-HANG M., YU-HUA Z. (2005): Isolation and characterization of a new carbendazim-degrading *Ralstonia* sp. strain. World Journal of Microbiology and Biotechnology **21,** 265-269.

HOLTMAN M. A. KOBAYASHI D.Y. (1997). "Identification of *Rhodococcus erythropolis* isolates capable of degrading the fungicide carbendazim." Applied Microbiology and Biotechnology **47,** 578-582.

SILVA, C.M.M.S - MELO, I.S. MAIA A.H.N. ABAKERLI R.B. (1999). "Isolation of carbendazim degrading fungi." Pesquisa Agropecuária Brasileira **34,** 1255-1264.

SILVA, C.M.M.S. FAY, E.F. MELO, I.S. (1996). "Degradação do fungicida carbendazim por *Phanerochaete chrysosporium.*" Fitopatologia Brasileira **21,** 496-498.

WILLEMS, A. DE LEY, J. GILLIS, M. KERSTERS, K. (1991) "*Comamonadaceae*, a new family encompassing the acidovorans rRNA complex, including *Variovorax paradoxus* gen. nov., comb. nov., for *Alcaligenes paradoxus"* (Davis) 1969. International Journal of Systematic Bacteriology **41,** 445-450.

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FUNCTIONAL DIVERSITY INVESTIGATION OF BACTERIAL COMMUNITIES IN DISTINCT SOIL TYPES WITH RISA AFTER PRECULTURING (RISA-APC) METHOD

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ABSTRACT – Functional diversity investigation of bacterial communities in distinct soil types with RISA after preculturing (RISA-APC) method.
Microorganisms play a leading role in soil development and preservation; moreover, they could indicate the soil health and conditions. In this study, we analyzed the bacterial composition of three different soil types with a newly developed RISA-APC method. A novelty of this method is the pre-culturing step: this preculturing of the bacterial communities were performed on solid media supplemented with different carbon sources (e.g.: carboxy-methyl cellulose, xylan, chitin, starch, tributyrin, casein and protocatechuic acid). For the investigation of heavy metal tolerant bacteria, a preculturing on YEG media containing $CuSO_4$ or $CdCl_2$ were used. The mini-colonies developed after a short incubation time was investigated. This RISA-APC method proved to be a useful tool for the comparison of different soil types, and for the examination of changes in the soil bacterial community structure. It was clearly shown that the most diverse functional diversity values occurred in the forest soil and the less diverse bacterial community was detected in sandy soil samples.

Keywords: bacterial community analysis, soil quality, soil type, preculturing, RISA-APC

INTRODUCTION

Soil is a very complex and dynamic biological system; microorganisms adapt to microhabitats and live there together in consortia. The extent of the diversity of microorganisms in soil seems to be critical to the maintenance of soil health and quality (RANJARD ET AL., 2001). Despite the relatively small biomass of the bacteria and fungi present in the soil, they play a key role in the carbon, nitrogen, sulphur and phosphor cycle (PANKHURST ET AL., 1997). Microbes affect the physical properties of the soil, for example the water holding capacity and soil structure (ELLIOTT ET AL., 1996). The chemicals, pesticides and heavy metals are significantly affecting the microbiological activities and trough this way, the soil health. The microbes respond very quickly to the external influences, so the investigation of the communities could refer to the different changes of the environmental factors (PANKHURST ET AL., 1995). For the rapid comparing studies of bacterial communities the most useful are the 16S rDNA genes. A large database of 16S rDNA sequences exists in the gene bank (www.ncbi.nlm.nih.gov) (NIELSEN AND WINDING, 2002). The region of the rRNA gene cluster between the small (16S) and large (23S) ribosomal RNA genes in bacteria is called the intergenic spacer region (ITS), which may encode tRNAs depending on the bacterial species, and displays significant heterogeneity in both length and nucleotide sequence. Both types of variation have been extensively used to distinguish bacterial strains and closely related species. The ITS length polymorphism could be visualized with gelelectophoresis, and the resulted fingerprint of fragments is

characteristic, such as a barcode and indicates the composition of the investigated bacterial community. In this study, we combined the RISA method with pre-culturing of the soil bacteria, and get a simple and reliable method for analyse and for compare different soil types.

MATERIAL AND METHOD

Sampling, culture conditions: Soil samples (top soils in all cases) were collected in Hungary from different areas, one from a wheat field, one from forest and one from sandy soil. The pre-culturing was performed on solid media containing (l^{-1}): agar 20 g, KH_2PO_4 5 g, $MgSO_4$ 1 g, $(NH_4)_2SO_4$ 1 g, supplemented with different carbon sources (2 g; carboxy-methyl cellulose, xylan, chitin, starch, tributyrin, casein and protocatechuic acid). As a control, a complex medium was used (l^{-1}): glucose 2 g, yeast extract 2 g, and agar 20 g. For the investigation of the heavy metal tolerance of bacteria, $CuSO_4$ or $CdCl_2$ were added to the complex medium. Fifty grams of the soil sample were diluted and homogenised in 50 ml isotonic NaCl solution (0.9%), and 50 µl aliquots were spreaded onto the agar plates. After desiccation, they were incubated at 20 °C for 20 hours. Isotonic NaCl solution (2 ml) was used to washed-down mini-colonies from the plates. The suspensions were centrifuged and the pellets were resuspended in 0.5 ml isotonic NaCl solution.

DNA isolation: The DNA isolation was carried out with Aqua Genomic Solution™ kit, according to the manufacturer's instructions.

PCR reaction, RISA: For the amplification of the bacterial ITS region, the Eub_ITSF as forward and Eub_ITSR as reverse primer were used. PCR was carried out in a final volume of 50 µl containing 5 µl of *Taq* polymerase 10x puffer, 1.6 mM $MgCl_2$, 200 µM for each of the dNTPs, 10 pM primers, 5 µl of template DNA (app. 100 ng) in distilled water and 1 U *Taq* DNA polymerase (Fermentas). The PCR product was visualized with gelelectophoresis, and the DNA fragments in the gels were stained with SYBR Green and analyzed under UV light.

RESULTS

RISA-APC profiles revealed different complexity resulted in by the different number and different relative intensity of their bands. From bacteriological point of view, the less complex habitat was the sandy soil (marked H). In many cases we did not get any bands after the PCR reaction, while culturing on complex medium resulted 9 bands. These sandy soil samples did not contain bacteria which could utilize the specific carbon sources tested. Forest soil sample (marked E) showed high diversity values on several carbon sources. The soil of wheat field (marked B) showed some similarity to soil sample of forest. However, substantial differences were observed in the number of the bands on carboxy-methyl cellulose, xylan and chitin (*Figure 1.*). This suggested the presence of bacteria with cellulose, xylan and chitin degrading potential. The estimated number of heavy metal resistant bacteria was nearly similar in forest and in wheat field samples (*Figure 2.*). A potential explanation is that both habitats can be exposed to these pollutants.

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Figure 1. RISA-APC profiles from different soils: B-wheat field soil, E-forest soil, H-sandy soil. The preculturing was performed on different carbon sources.

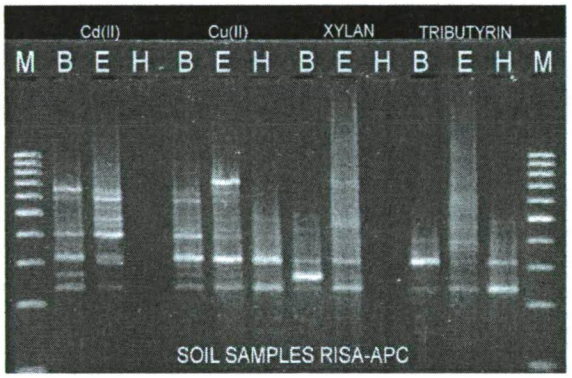

Figure 2. RISA-APC profiles from different soils. B-wheat field, E-forest soil, H-sandy soil. Cd(II) and Cu(II): the lines of metal resistant bacterial communities.

Fingerprint experiments showed high reproducibility, no difference were detected between replicates of RISA profiles obtained from amplifications of triplicate DNA extracts. The RISA-APC profiles were manually compared. The number of bands observed is summarized in *Table 1*.

Table 1: Comparison of RISA profiles (number of bands after PCR reaction).

Carbon source/heavy metal	H (sandy soil)	E (forest)	B (wheat field)
carboxy-methyl cellulose	0	13	3
xylan	0	9	6
chitin	0	4	1
starch	0	12	8
tributyrin	3	10	6
casein	4	8	5
protocatechuic acid	8	9	9
glucose	9	7	2
Cu (II)	6	10	9
Cd (II)	0	9	6

CONCLUSIONS

The results of RISA-APC clearly correlated, as regards the complexity of RISA-fingerprints, with the expected basic taxonomical complexity of various soil types. These results showed that the highest functional diversity values occurred in the forest soil, while the lowest were present in the sandy soil.

The distribution of the band number is similar in the case of preculturing on protocatechuic acid, a product of lignin biodegradation. The greatest differences were detected on carboxy-methyl cellulose, xylan and chitin carbon sources (Figure 3). The background of this result could be the high microbial diversity of forest surface soils. Dead plant material mostly consists of cellulose and xylan, which explains the presence of these types of degraders in high numbers. Similarly, the high incidence of chitin degrading bacteria in the forest soil could be explained with the presence of insects and fungi in this habitat.

The RISA-APC method developed in our study proved to be a useful tool for the comparison of different soil types, and for the examination of changes in the soil bacterial community structure. Furthermore, this approach could be combined with various statistical methods to analyse these correlations in detail. The main disadvantage of this approach is that the results do not provide bases for a precise species or genus identification (FISHER AND TRIPLETT 1999; JENSEN ET AL., 1993).

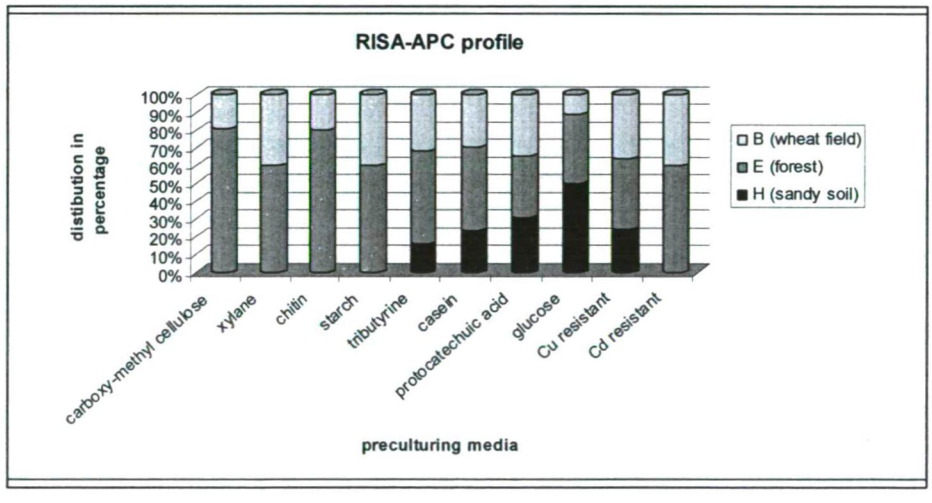

Figure 3. The diagram shows the number of the resulted bands with RISA-APC after preculturing on the different carbon sources or in the presence of heavy metals.

ACKNOWLEDGEMENTS

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REFERENCES

ELLIOTT L., LYNCH F.J.M., PAPENDICK R. I. (1996): The microbial component of soil quality. Soil Biochemistry. Stotzky G., Bollag J.-M, (eds.). Marcel Dekker Inc., New York, p.1-21.

FISHER M.M., TRIPLETT E.W, (1999): Automated approach for ribosomal intergenic spacer analysis of microbial diversity and its application to freshwater bacterial communities. Applied and Environmental Microbiology **65,** 4630-4636.

JENSEN MA., WEBSTER JA., STRAUS N, (1993): Rapid identification of bacteria on the basis of polymerase chain reaction amplified ribosomal DNA spacer polymorphism. Applied and Environmental Microbiology **59**, 945-952.

PANKHURST C.E., DOUBE B.M., GUPTA V.V.S.R, (1997): Biological indicators of soil health: Synthesis. Biological Indicators of Soil Health. Pankhurst, C. E., Doube, B. M., Gupta, V. V. S. R. (eds.). CAB International, p.419-435

PANKHURST C.E., HAWKE B.G., MCDONALD H.J., KIRKBY C.A., BUCKERFIELD J.C., MICHELSEN P., O'BRIEN K.A., GUPTA V.V.S.R., DOUBE B.M, (1995): Evaluation of soil biological properties as potential bioindicators of soil health. Australian Journal of Experimental Agriculture **35,** 1015-1028.

RANJARD L., POLY F., LATA J.-C., MOUGEL C., THIOULOUSE J. NAZARET S, (2001): Characterization of bacterial and fungal soil communities by automated ribosomal intergenic spacer analysis fingerprints: biological and methodological variability. Applied and Environmental Microbiology **67,** 4479-4487.

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EFFECT OF YOLK RATIO IN HEN'S EGGS ON THE HATCHING WEIGHT AND ON THE HEART AND LIVER RATIO IN CHICKS AT HATCHING

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ABSTRACT – Effect of yolk ratio in hen's eggs on the hatching weight and on the heart and liver ratio in chicks at hatching

The aim of this study was to examine, whether the yolk ratio of hen's eggs has an effect on the hatching weight and on the heart and liver ratio in chicks at hatching. Altogether 3.500 hen's eggs – originated from a 24 weeks old TETRA-H parent stock – were involved in the examination. The yolk ratio of these eggs was determined by means of computer tomography *in vivo* using a SIEMENS Somatom Emotion 6 multislice CT scanner at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University. Based on the measured values eggs were separated into three groups: eggs with extreme high, eggs with average and eggs with extreme low yolk content (10-10% in each group). All of these eggs (n=350 per group) were incubated thereafter. After hatching 30 chicks per group (15 males and 15 females) were randomly chosen and their liveweight was measured thereafter. After measuring the liveweight chicks were killed and dissected. The weight of the heart and liver was measured and their ratio to the hatching weight was calculated. Based on the results it was established that the hatching weight of the chicks decreased with increasing the yolk ratio in the eggs in both sexes. In spite of the hatching weight the ratio of the heart to the hatching weight was increasing with increasing the yolk ratio in the breeding eggs in the case of the cocks. In the case of the pullets the opposite tendency was observed. The change in the ratio of liver to the hatching weight showed similar tendency in the case of cocks as it was observed in the case of the heart. In the case of the pullets no clear tendency was observed in this trait. Based on the results it was concluded that – according to some former results – the higher albumen content in the eggs results in higher hatching weight and the higher yolk content in the eggs in better body composition in the chicks.

Keywords: egg yolk content, computer tomography, chicken, hatching weight, body composition

INTRODUCTION

In poultry breeding, it is an old question, whether the size or the composition of the eggs has greater effect on the viability of the offspring. In former studies it was already observed that the mass of the eggs and also that of the egg yolk increases parallel with the age of layers (APPLEGATE et al., 1998; HARTMANN et al., 2000; SILVERSIDES and SCOTT, 2001; OLOYO, 2003). Experiments that followed up the development of embryos and the birds hatched have clearly demonstrated that in eggs laid by young layers the development of embryos is slower than in those laid by older ones (APPLEGATE, 2002). It was supposed that this is partially due to the higher egg yolk ratio of eggs from older birds, which enables a more substantial incorporation of nutrients into the organism of the developing embryo.
Over a long period of time, elucidation of the correlations between the composition of hatching eggs and the development of the birds hatched was hampered by the lack of

instruments that would have been capable of determining the composition of eggs without opening them. An attempt for determining the chemical composition of intact eggs was made by WILLIAMS et al. (1997), using the so-called TOBEC (Total Body Electrical Conductivity) method in their study. In this experiment it was demonstrated that there are significant correlations between the so-called E-values measured by the TOBEC method (the electrical conductivity of the eggs) and the water content of the eggs as well as the dry matter content of the albumen in all the four species studied (chicken, duck, guinea fowl and quail).

Relying on the results of WILLIAMS et al. (1997), studies on the examination of correlations between egg composition, hatchability and hatched bird's development have recently been started at the Kaposvár University as well. This study demonstrated that, eggs of different composition – i.e., having dissimilar yolk/albumen ratios – have significantly deviating hatchability, and that the birds hatching from these eggs have significantly different body composition at the time of hatching and significantly different growth rate during rearing and finishing (MILISITS et al., 2008a, 2008b). In spite of the favourable results the biggest disadvantage of the TOBEC method is the only moderate correlation between the electrical conductivity and the composition of eggs and therefore it is not suitable for demonstrating minor changes in egg composition, and is reliable only for distinguishing eggs with extremely divergent composition (MILISITS et al., 2007). Therefore, in this study another technique, namely computer tomography (CT) was used for predicting the egg composition (yolk content) *in vivo* and for examining the effect of egg yolk ratio on the hatching weight and on the heart and liver ratio in chicks at hatching.

MATERIAL AND METHODS

Altogether 3.500 hen's eggs – originated from a 24 weeks old TETRA-H parent stock – were involved in the examination. The yolk ratio of these eggs was determined *in vivo* by means of computer tomography using a SIEMENS Somatom Emotion 6 multislice CT scanner (*Figure 1*) at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University. Before the scanning procedure all of the eggs were weighed and positioned for the scanning in standing/upright position. During the CT measurements eggs were positioned in egg trays (30 eggs), thus five eggs were scanned simultaneously (*Figure 2*).

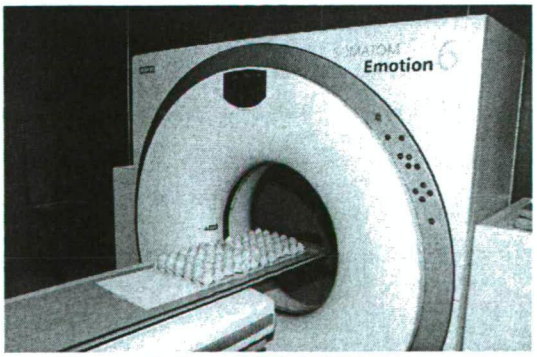

Figure 1: The SIEMENS Somatom Emotion 6 multislice CT scanner

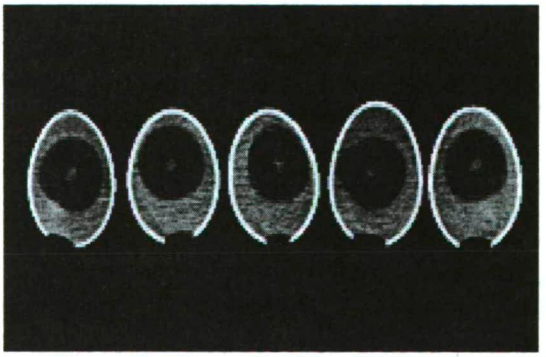

Figure 2: Cross-sectional CT image of five simultaneuously scanned hen's eggs

The CT examinations were carried out by using the following technical parameters: tube voltage: 110 kV, X-ray radiation dose: 80mAs, mode: spiral, pitch: 1, field of view: 110 mm. From all of the eggs 3 mm thick overlapping slices were taken. The images obtained were analysed by a new self-developed egg-separation and segmentation software. With the help of this software the border of the shell and albumen and the border of the albumen and yolk was determined and the volume of the yolk was calculated thereafter.
Based on the measured values eggs were separated into three groups: eggs with extreme high (28.2±0.90 %), eggs with average (24.6±0.15 %) and eggs with extreme low (21.2±0.86 %) yolk content (10-10 % in each group). All of these eggs (n=350 per group) were incubated thereafter. After hatching 30 chicks per group (15 males and 15 females) were randomly chosen and their liveweight was measured thereafter. After measuring the liveweight chicks were killed by a lethal dose of penthobarbital, intraperitoneally and dissected thereafter. The weight of the heart and liver was measured and their ratio to the hatching weight was calculated.The differences in the hatching weight and in the heart and liver ratio between the experimental groups were evaluated statistically by using the One-Way ANOVA method. The statistical analysis was carried out by the SPSS statistical sofware package, version 10.0 (SPSS FOR WINDOWS, 1999).

RESULTS

Examining the hatching weight of the chicks it was established that it was decreasing with increasing the yolk ratio in the breeding eggs in both sexes (*Figure 3*).

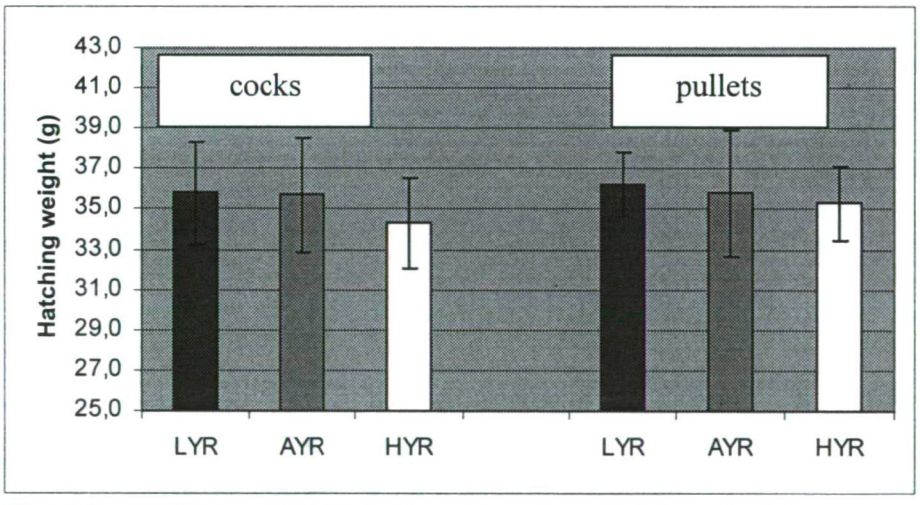

Figure 3: Hatching weight of TETRA-H cocks and pullets hatched from eggs with low (LYR), average (AYR) and high (HYR) yolk ratio

The hatching weight of the chicks hatched from eggs with high yolk ratio was lower by 4.2% in the case of cocks and by 2.5% in the case of pullets than that of the chicks hatched from eggs with low yolk ratio. The hatching weight of the chicks hatched from eggs with average yolk ratio was between the hatching weight of chicks hatched from eggs with high or low yolk ratio in both sexes. However, in spite of this clear tendencies the between group differences were statistically not proven neither in the case of cocks nor in the case of pullets (P>0.05).
In spite of the hatching weight the ratio of the heart to the hatching weight was increasing with increasing the yolk ratio in the breeding eggs in the case of cocks (*Figure 4*).

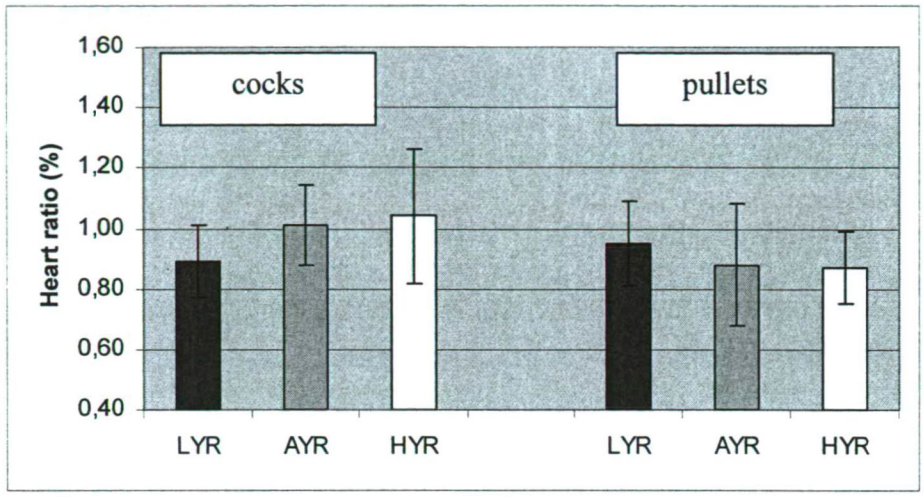

Figure 4: Heart ratio to hatching weight in TETRA-H cocks and pullets hatched from eggs with low (LYR), average (AYR) and high (HYR) yolk ratio

The ratio of the heart to the hatching weight in the cocks hatched from eggs with high yolk content was higher by 16.9% than that of the cocks hatched from eggs with low yolk content. The difference observed between these groups was statistically significant at $P<0.05$ level.

In the case of the pullets the opposite tendency was observed. In these birds the ratio of the heart to the hatching weight was decreasing with increasing the yolk ratio in the breeding eggs. Between the two extreme groups 9.2% difference was observed, but it was not statistically proven ($P<0.05$) in this case.

The change in the ratio of liver to the hatching weight showed similar tendency in the case of cocks as it was observed in the case of the heart (*Figure 5*).

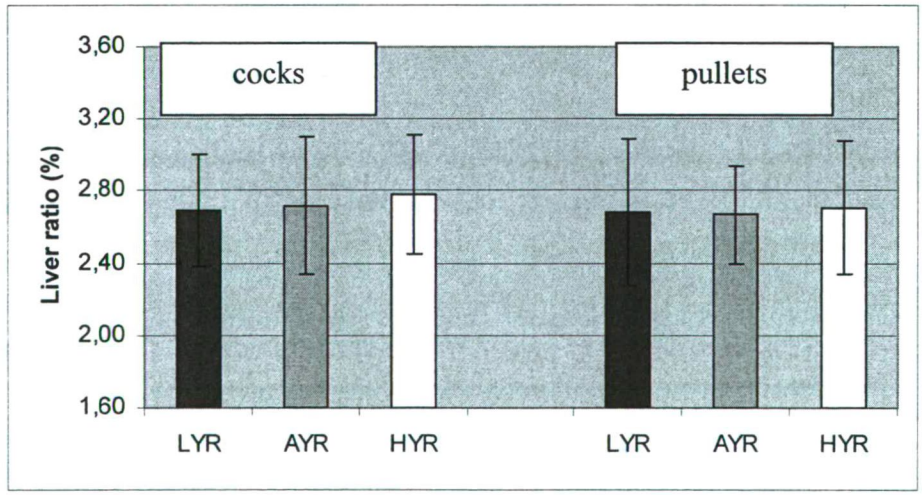

Figure 5: Liver ratio to hatching weight in TETRA-H cocks and pullets hatched from eggs with low (LYR), average (AYR) and high (HYR) yolk ratio

The ratio of liver to the hatching weight was higher by 3.3% in the cocks hatched from eggs with high yolk content than in those hatched from eggs with low yolk content. The between group differences were not statistically proven in this case ($P>0.05$).

In the case of the pullets no clear tendency was observed in this trait. The data obtained were very similar in all of the examined groups (2.67-2.71%).

CONCLUSIONS

Based on the results it was concluded that the yolk ratio in hen's eggs has an influence on the hatching weight and on the heart and liver ratio of the hatched chicks. According to some former results it was established that the higher albumen content in the eggs resulted in higher hatching weight and the higher yolk content in the eggs in better body composition in the chicks. Because the hatching weight and the body composition could have an effect on the further development of the hatched chicks, the further examination of the effect of egg composition on the growth and development of the hatched chicks seems to be necessary.

ACKNOWLEDGEMENT

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REFERENCES

APPLEGATE, T.J. (2002): Reproductive maturity of turkey hens: egg composition, embryonic growth and hatchling transition. *Avian and Poultry Biology Reviews*, 13 (1), 31-41.

APPLEGATE, T.J., HARPER, D., LILBURN, M.S. (1998): Effect of hen production age on egg composition and embryo development in commercial pekin ducks. *Poultry Science*, 77 (11), 1608-1612.

HARTMANN, C., JOHANSSON, K., STRANDBERG, E., WILHELMSON, M. (2000): One-generation divergent selection on large and small yolk proportions in a White Leghorn line. *Poultry Science*, 41 (3), 280-286.

MILISITS, G., KOVÁCS, E., LOCSMÁNDI, L., SZABÓ, A., ANDRÁSSY-BAKA, G., JEKKEL, G., ROMVÁRI, R. (2007): Applicability of the TOBEC method in selection of hen's eggs based on their composition. *Agriculture,* 13 (1), 209-212.

MILISITS, G., KOVÁCS, E., PŐCZE, O., UJVÁRI, J., TARASZENKÓ, ZS., JEKKEL, G., LOCSMÁNDI, L., BÁZÁR, GY., ROMVÁRI, R., SÜTŐ, Z. (2008a): Effect of hen's eggs composition on the hatchability and on the hatching weight and body composition of chicks in two meat-type genotypes. *XXIII World's Poultry Congress*, Brisbane (Australia), 30 June - 4 July 2008, CD-ROM.

MILISITS, G., KOVÁCS, E., PŐCZE, O., UJVÁRI, J., TARASZENKÓ, ZS., JEKKEL, G., LOCSMÁNDI, L., BÁZÁR, GY., ROMVÁRI, R., SÜTŐ, Z. (2008b): Effect of hen's eggs composition on the growth and slaughter characteristics of hatched chicks in two meat-type genotypes. *XXIII World's Poultry Congress*, Brisbane (Australia), 30 June - 4 July 2008, CD-ROM.

OLOYO, R.A. (2003): Effect of age on total lipid and cholesterol of hen eggs. *Indian Journal of Animal Sciences*, 73 (1), 94-96.

SILVERSIDES, F.G., SCOTT, T.A. (2001): Effect of storage and layer age on quality of eggs from two lines of hens. *Poultry Science*, 80 (8), 1240-1245.

SPSS FOR WINDOWS (1999): Version 10.0, Copyright SPSS Inc.

WILLIAMS, T.D., MONAGHAN, P., MITCHELL, P.I., SCOTT, I., HOUSTON, D.G., RAMSEY, S., ENSOR, K. (1997): Evaluation of a non-destructive method for determining egg composition using total body electrical conductivity (TOBEC) measurements. *Journal of Zoology*, 243 (3), 611-622.

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COMPARISON OF EURASIAN WOODCOCK (*SCOLOPAX RUSTICOLA, L.*) MONITORING METHODS

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ABSTRACT – Comparison of Eurasian Woodcock (*Scolopax rusticola*) monitoring methods
Eurasian woodcock is a popular migrating game species in Hungary and in several European countries. For its wise management it is essential to collect reliable information of the breeding, wintering and also migrating populations. The aim of this study was to describe and analyze the differences among the monitoring methods used in different countries, and to give advices to improve the methods of data collection and evaluation of the monitoring system running in Hungary. Our study is based on the comparison of monitoring programs run in France, Russia, Belarus and in the Archipelago Azores. The key factor of all such surveys is the display behaviour of male birds, which is called roding. However there are some differences between them. We evaluated the different monitoring methods on the basis of scientific literature considering the place, time and duration of survey sessions, the collected data and the methods of their analysis. The main cause of differences is the different aim of the different studies. Hungary cannot obviously be taken as a breeding or wintering area, it rather plays an important role in migration. The aim of the monitoring in Hungary is to follow and characterize the flow of migration, and to estimate the minimal number of birds crossing our countries borders. The evaluation of data in Hungary is also different. However the methods of observations and the quantity of collected data allow us to evaluate our data in a similar way. It would be essential if we would like to compare our results to the results of other monitoring programs in Europe.

Keywords: Eurasian woodcock, *Scolopax rusticola*, monitoring, survey method, observation

INTRODUCTION

To broaden our knowledge and to estimate the size of the migrating population of the Eurasian woodcock in Hungary, a country-wide monitoring program started in spring 2009. However woodcock *(Scolopax rusticola)* is a difficult species to count accurately, because it spends the day in woodland and feeds on fields during the night. There are three basic counting methods described by BIBBY ET AL. (1997): (1) Counts of displaying males where the counting unit is the displaying "roding" male. The counting period is throughout the breeding season. During spring and summer evenings, male woodcocks perform song flights over their breeding sites (roding). The breeding survey is based on a census of those males (FERRAND, 1993). As several birds may be counted at the same listening point where it is not easy to distinguish them, the collected data is simply the number of contacts (birds seen and/or heard). However, a positive correlation between the number of contacts and the number of different birds was proved by an acoustic analysis (FERRAND, 1993). (2) Drives with beaters where the counting unit is the individual bird being flushed by teams of beaters and dogs. Drives should be undertaken during the winter in the day-time. (3) Nocturnal feeding counts. The counting unit is the individual bird. These are counted as they fly to or from nocturnal feeding areas at dusk or dawn. Counts can be undertaken throughout the year.

The Hungarian monitoring program is based on roding surveys, so in our study we focused on countries using methods similar to ours. The aim of this study was to describe and analyze the differences among the monitoring methods used in different countries, and to give advices to improve the methods of data collection and evaluation of the monitoring system running in Hungary

MATERIAL AND METHOD

We evaluated the different monitoring methods on the basis of scientific literature considering the place, time and duration of survey sessions, the collected data and the methods of their analysis.

Our most important source of information was the network of the Woodcock and Snipe Specialist Group. It is a research unit of Wetlands International (WI) and of IUCN, the International Union for Conservation of Nature. Their annual newsletter is a contact organ to inform their members about the latest results of Woodcock and Snipe *(Gallinago spp.)* research.

Furthermore, every five years on average, the WSSG organizes a workshop to provide information on Woodcock and Snipe research whereby their members are offered the opportunity to meet and improve the efficiency of the network. The last (sixth) workshop was held in Nantes, France. Previous ones were held in Denmark, Great Britain, Germany, and Poland. In the last five years the following countries published results of their monitoring programs regularly: France, Russia, Portugal (Archipelago Azores), and Belarus.

France is an important wintering area for the Eurasian woodcock, and it is also a breeding area. To manage this game species wisely an integrated monitoring system for the breeding and wintering woodcock populations has been developed (FERRAND ET AL., 2008), based on a census of roding males, the census of woodcocks flushed and/or shot during hunting trips, a census of woodcocks from targeted ringing sessions and other ringing data.
The majority of Woodcock wintering in Europe are nesting in the Russian forests. For a long time, it has been a necessity to monitor the number of this species during the display period. However, this has been put into practice only a few years ago with the financial and methodological support of the French Office National de la Chasse et de la Faune Sauvage. Questionnaires are filled out by observers for one evening of roding observed at one census point. The national roding census is conducted on one common day for the whole country – the last Saturday of May. In 2010 the National Woodcock Roding Census was organized by the Moscow scientific "Woodcock" group, the Association Rosokhotrybolovsoyuz, several hunting offices and the "Russian hunter" newspaper (FOKIN ET AL., 2010).

In contrast to its mainly migrant continental populations the Eurasian woodcock is a resident species in the Macaronesian archipelagos (Azores, Madeira and Canaries). Working at Pico Island, their main objectives were to characterize the roding activity of these insular populations, to select the best peiod of the breeding season to perform a roding survey and to evaluate how sensitive this method can be to variations in abundance because of hunting (MACHADO ET AL., 2008). They followed the survey protocol described by FERRAND (1993).

To estimate the size of the migrating population in Hungary, a monitoring program was initiated by the former Ministry of Agriculture and Rural Development and the Hungarian National Chamber of Hunters in 2009. Data collection and processing have been designed and carried out by Szent István University, Institute for Wildlife Conservation which also assumed to evaluate the results. The objective was to collect data from as many observation points as possible at the same period of time. These give then snapshots about different states of the migration. With the comparison of consecutive snapshots it is possible to estimate the dynamics, speed and extent of migration. The basis of the monitoring program is a roding survey weekly performed by observers on every Saturday (from 28th February to 2nd May in spring 2009, from 13th February to 1st May in Spring 2010). The observers record data on standardized forms. Data are: number of contacts (birds seen and/or heard), size of the visible area, duration of the survey, weather conditions and habitat types surrounding the observation point. The total number of observation points was 908 in spring 2010. *Figure 1* shows their distribution.

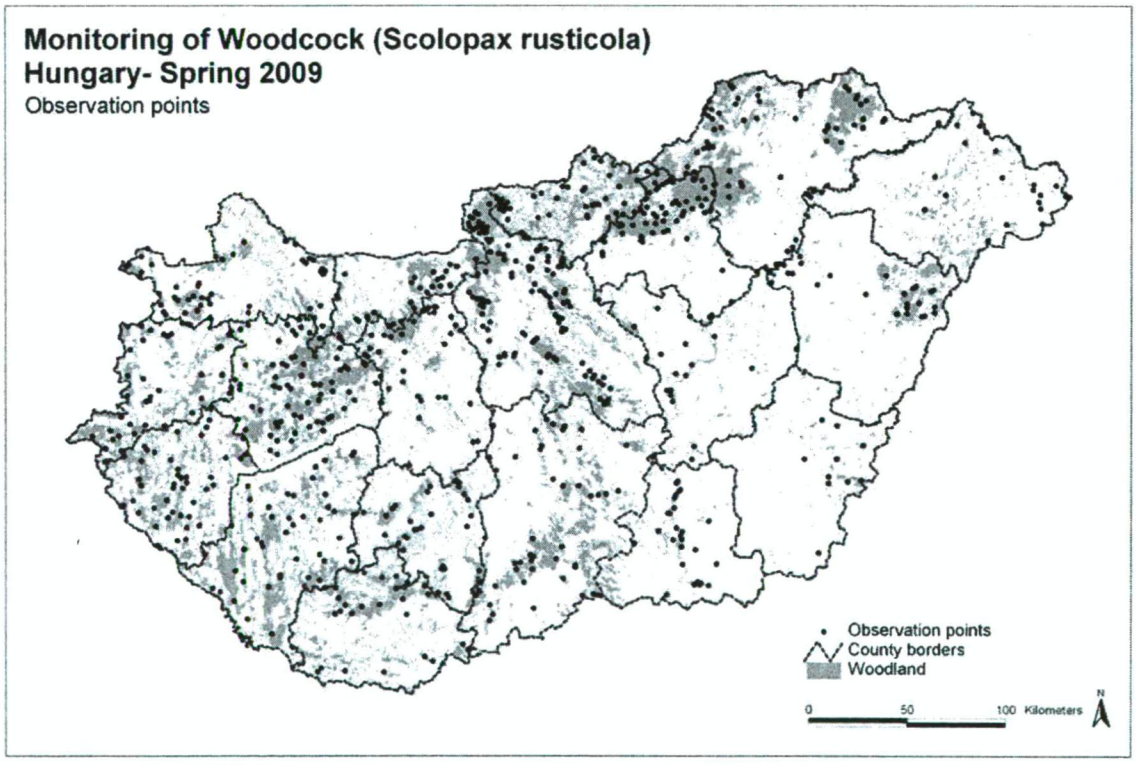

Figure 1. Woodcock observation points in Hungary – spring 2009

We compared the methods and results of their programs with the Hungarian monitoring program. The comparisons have been made considering the following questions:
(1)Why are they collecting data? (2) How do they collect data? (3)When do they collect data? (4)Where do they collect data? (5) How much data do they collect? (6) What results do they get?

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RESULTS

Our most important results are summarized in *Table 1.*

Table 1. The main characteristics of the woodcock monitoring programs in five different European countries

	France	Russia	Archipelago Azores (Portugal)	Belarus	Hungary
Aim of the roding surveys	Breeding population survey	Breeding population survey	Breeding population survey	Breeding population survey	Migrating population survey
Coverage	National	National	Local (Azores archipelago)	Local (Berezinsky Reserve)	National
Since when	1992	1999	2001	2005	2009
N of observation points	860 (in 2010)	2455 (in 2010)	22 (in 2009)	12 (in 2009) (between 2005-2008 it was 60)	908 (in Spring 2010)
Annual frequency of observations	1	1	1-2	1	12 in Spring
Observation period	Between Mid-May and Mid-June	The last Saturday of May	March-April	June	Between Mid-February and the beginning of May
Counting unit	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)	Number of contacts (birds seen and/or heard)
Results/evaluation of data	National occupation rate, proportion of high abundance sites	Roding intensity	Breeding abundance	Mean N of contacts	Mean N of contacts; Dynamics of migration
Additional monitoring programs	Ringing trips, hunting trips, hunting bag statistics	Ringing trips, hunting bag statistics	Hunting trips, hunting bag statistics	Ringing trips, hunting bag statistics	Autumn migration monitoring (Nocturnal feeding count); Hunting bag statistics

(1) The aim of roding survey studies is the monitoring of breeding population in each country except for Hungary. Our aim is to estimate the size of the migrating population.
(2) There are only minor differences between the methods of data collection by roding surveys.They are mostly differences in additional data collection. There are two additional indices which allow the monitoring of woodcock migratory and wintering numbers in France: (a) the mean number of contacts/hour registered during ringing trips and (b) a hunting index (number of seen woodcocks/standardized hunting trip, duration= 3.5 hours) collected by the Club National des Bécassiers (GOSSMANN ET AL., 2009).

The main task of an additional project in Belarus is to ring Woodcock during the autumn migration (MONGIN ET AL., 2009). Woodcock ringing and study of migration were carried out in the Berezinsky Reserve vicinities on several stationery plots. The main study period was 16 September – 9 November. They recorded 391 birds during 51 night trips, 76 woodcocks were caught during the season.

(3) The timing of data collection is very similar in France, Russia, and Belarus (May-June). In Azores and Hungary observations are carried out earlier (March-April).
Censuses lasted 120 minutes in Russia and in Belarus too. The observations in Hungary last only one hour after dusk. In Azores observations always began at least 1 hour before sunset and stopped half an hour after the last contact was registered.

(4) The observation points cover the whole area of the country in France, Russia, and Hungary. The Archipelago Azores is a smaller part of Portugal, however the woodcock

population there is resident, so the monitoring can be taken as full-cover. In Belarus the covered area decreased with the decline of the number observation points in 2009. In France observations are carried out every year at listening points randomly chosen in forest habitats. A listening point is defined as an open area (clearing, plantation, etc) as close as possible to the centre of a 2x2 centigrade square. In Russia the observers should choose an open place in a forest, the criteria is that it should be suitable for roding and for observations. In Belarus the listening points were located in two squares (12x12 km).

(5) The number of the observation points was the highest in Russia, and the lowest in Belarus. Census of the breeding population in Belarus was carried out at 12 listening points during June in an area called Berezinsky Reserve. However until 2008 the number of the observation points in Belarus was much higher. The highest annual frequency of observations is in Hungary. In the Archipelago Azores the frequency of data collection was similar to ours, because the researchers tried to describe the characteristics of the intensity of roding throughout the breeding season. According to their results, they selected then a shorter period of time for monitoring the population trend.

(6) The most important results in France are (a) the national occupation rate (the % of listening points at which at least one roding male was observed). In 2010, the value was 23.6% (GOSSMANN ET AL., 2010). (b) The proportion of high abundance sites (number of contacts $\geq$ 5), was 7.9%. The population trend of the French breeding woodcock population has been analysed for the last 10-year period. The stability of proportion of positive site and of the proportion of high abundance sites characterizes this period. After a period of increase observed since the end of the 1990s, the breeding woodcock numbers in France seem to have reached a plateau.

The results of monitoring in Russia showed that roding intensity in 2010 was the lowest in the last 12 years. Owing to hot and dry weather conditions in summer 2010, roding stopped by 10 july, approximately 2 weeks earlier than usual (FOKIN ET AL., 2010).

CONCLUSIONS

The methods of data collection are very similar in each country; the key factor is the display behaviour of male birds. It is obvious, because it is one of the most effective methods, which was described properly by FERRAND (1993) and could be easily adopted for the studies in the case of Russia, Belarus, and Azores. In Hungary, it was not adopted directly, but it is still analogous. The sampling is representative, standardized (repeatable), and regular in each studied country. There are only minor differences which are caused by local circumstances (e.g. timing, duration).

The main cause is the different aim of the different studies. Hungary cannot obviously be taken as a breeding or wintering area, it rather plays an important role in migration. The aim of the monitoring in Hungary is to follow and characterize the flow of migration, and to estimate the minimal number of birds crossing our countries borders. Therefore the monitoring in Hungary takes a much longer period of time - with the highest annual frequency - of observations than in France or Russia.

The evaluation of data in Hungary is also different from the countries mentioned in our study, because the different aims of the programs. However the methods of observations

and the quantity of collected data allow us to evaluate our data in a similar way. It would be essential if we would like to compare our results to the results of other monitoring programs in Europe. It would also be a step forward in creating an international cooperation of monitoring programs which could allow us to see the population as a whole.

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REFERENCES

BIBBY, C. J., BURGESS, N. D., HILL, D. A. (1997): Bird Census Techniques. Academic Press Limited, London. 257p.

BLOKHIN, Y. Y., FOKIN, S. Y. (2006): National roding censuses in Russia. In: Ferrand Y (2006): Sixth European Woodcock and Snipe Workshop – Proccedings o fan International Symposium of the Wetlands International Woodcock and Snipie Specialist Group, 25-27 November 2003, Nantes, France. International Wader Studies 13, Wageningen, The Netherlands, 114pp.

FERRAND, Y. (1993): A census method for roding Eurasian Woodcocks in France. Biol Rep 16: 19–25.

FERRAND, Y., GOSSMANN, F., BASTAT, C., GUÉNÉZAN, M. (2008): Monitoring of the wintering and breeding Woodcock populations in France. Revista Catalana d'Ornitologia 24: 44-52.

FOKIN, S., BLOKHIN, Y., ZVEREV, P., ROMANOV, Y., KOZLOVA, M. (2010): Abnormal hot and dry summer in Russia in 2010: impact on the Woodcock breeding success and autumn migration. WI/IUCN-WSSG Newsletter 36: 8-12.

GOSSMANN, F., BASTAT, C., GUÉNÉZAN, M., FERRAND, Y. (2009): 2008-2009 French Woodcock report. WI/IUCN-WSSG Newsletter 35: 34-37.

GOSSMANN, F., BASTAT, C., GUÉNÉZAN, M., FERRAND, Y. (2010): 2009-2010 French Woodcock report. WI/IUCN-WSSG Newsletter 36: 25-28.

MACHADO, A. L., FERRAND, Y., GOSSMANN, F., SILVEIRA, A. M., GONÇALVES, D. (2006): Woodcock (Scolopx rusticola) breeding biology in Pico Island (Azores, Portugal). In: Ferrand, Y (2006): Sixth European Woodcock and Snipe Workshop – Proccedings o fan International Symposium of the Wetlands International Woodcock and Snipie Specialist Group, 25-27 November 2003, Nantes, France. International Wader Studies 13, Wageningen, The Netherlands, 114pp.

MACHADO, A. L., FERRAND, Y., GOSSMANN, F., SILVEIRA, A. M., GONÇALVES, D. (2008): Application of a roding survey method to the sedentary Eurasian Woodcock Scolopx rusticola population in Pico Island, Azores. European Journal of Wildlife Research 54: 205-214.

MONGIN, E., BOGUTSKI, Y., DAVIDYONOK, E., MONGIN, A. (2009): 2009 Belarus Woodcock Report. WI/IUCN-WSSG Newsletter 35: 8-9.

MONGIN, E., BOGUTSKI, Y., DAVIDYONOK, E. (2010): 2010 Belarus Woodcock Report. WI/IUCN-WSSG Newsletter 36: 4-5.

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RESISTANCE OF *VENTURIA INAEQUALIS* TO HEXACONAZOLE, TRIFLOXISTROBIN AND CAPTAN

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ABSTRACT - RESISTANCE of *Venturia inaequalis* to HEXACONAZOLE, TRIFLOXISTROBIN and CAPTAN

4.3% of 2.2 million tons of apple produced in Turkey annually is obtained from Çanakkale. Apple scab caused by *Venturia inaequalis* (Cooke.) Wint. is the most important problem observed in the apples growing in the province. Especially if the disease pressure is high, it cannot be controlled and thus it causes a significant loss in yield and quality despite the intensive spraying against the disease.

The objective of this study was to investigate whether this problem originated from fungicide sensitivity. Sensitivities of *V. inaequalis* isolates to hexaconazole (DMI), trifloxystrobin (Strobilurin) and Captan (Trichloromethylthiocarboxamide) were determined for twenty isolates by measuring the germination rate of conidiospore obtained from single scab lesions. According to ED_{50} value, the isolates treated with captan and hexaconazole varied from 0.01 to 0.3 µg/ml. The sensitivity of the isolates to both fungicides was found less than the sensitivity to trifloxystrobin. The isolates treated with trifloxystrobin were divided in two groups (0.01-0.03 and 0.03-01 µg/ml). On the other hand, according to minimum inhibition concentration, the isolates at captan and trifloxystrobin were in three groups (0.3-1; 1-3 and 3-10 µg/ml), however for hexaconazole they were in two groups (1-3 and 3-10 µg/ml).

In vitro studies showed that the sensitivity of *V. inaequalis* to Demethylation Inhibitor fungicide hexaconazole and Trichloromethylthiocarboxamide fungicide captan was reduced.

Keywords: *Venturia inaequalis*, sensitivity, fungicide.

INTRODUCTION

In Turkey *Venturia inaequalis* is one of the most important apple diseases and causes serious losses of yield and quality (TÜRKOĞLU, 1956; BENLIOĞLU AND KILIÇ, 1995). The producers apply 14-15 sprayings in a vegetation period if climatic conditions are favorable for the disease. Nevertheless, *Venturia inaequalis* cannot be controlled in some gardens despite intensive spraying. The failure in the combat against apple *Venturia inaequalis* has been associated with the decrease in the sensitivity of *V. inaequalis* as a consequence of the use of DMIs for long years against the disease (SMITH ET AL., 1991; SHOLBERG AND HAAG, 1993; ROBERTS AND CRUT, 1994; PALANI AND LALITAKUMARI, 1999; KÖLLER AND WILCOX, 2001). Hexaconazole and captan have long been used in Turkey against apple *Venturia inaequalis*. Floxystrobin, on the other hand, began to be used only recently compared to the other two fungicides. BENLIOĞLU AND KILIÇ (1995) found that the sensitivity of the isolates they collected from the province of Eğridir in Isparta (Turkey) to hexaconazole and flusilazole had decreased. Although *V. inaequalis* conidia with reduced sensitivity to Qol inhibitors were obtained in another study from the garden treated with trifloxystrobin, it was determined that the performance of the fungicides in the group was not reduced, yet they had resistance risks (KÜNG FÄRBER ET AL., 2000). On the other hand,

KÖLLER ÉT AL. (2004) reported that the isolates obtained from the gardens treated with QoI had high sensitivity to kresoxim-methyl and trifloxystrobin and that this finding was characterized with G143A cytochrome *b* mutants.
In this study, the sensitivity of *V. inaequalis* isolates obtained from the apple gardens in Çanakkale to hexaconazole, floxystrobin and captan was investigated.

MATERIAL AND METHOD

Venturia inaequalis isolation and production

The leaves infected with *Venturia inaequalis* in 2010 vegetation period were collected from the apple gardens in four different locations of Çanakkale, and they were placed into polyethylene bags and transferred to the laboratory in cooling containers. Sterile pure water (25 µl/ml) with Tween 85 was dropped on the leaf lesions inside the sterile container with the help of a micropipette, and conidiospores permeated into the water. Conidial suspension was inoculated into the water agar inside the petri dishes. The conidiospores germinated in the water agar medium were taken and inoculated into PDA (Potato Dextrose Agar) medium, and single conidium cultures were obtained by incubating at 20 °C for 18 days. *V. inaequalis* cultures developed in PDA medium were transferred into petri dishes and tubes with sterile PDYA (Potato Dextrose Yeast Extract Agar) medium and incubated at 20 °C for 30 days. The cultures developed in PDA medium were then transferred to VE medium (Apple Juice-Malt Extract Amino Acid Solution) and left to incubation at 20 °C for 25 days.

Determination of the sensitivity of isolates to fungicides

Conidia obtained from the cultures developed in VE medium were taken and spore suspension was prepared in the density of 10^5 conidium/ml. Spore suspension (25 µl) was inoculated into petri dishes with PDA to which trifloxystrobin, hexaconazole and captan were added (0,001; 0,003; 0,01; 0,03; 0,1; 0,3; 1;3 and 10 µg effective material/ml) with the help of a micropipette. Only sterile pure water was placed into the control petri dishes. The petri dishes were inhibited in the dark with 7% formalin at 20 °C for 48 hours after inoculation. After inhibition, the conidia inside the petri dishes (100 conidia/petri) germinated, atrophied, and were considered ungerminated. Conidia with a tube twice longer than conidium in the counts were considered as germinated (Fig. 1).

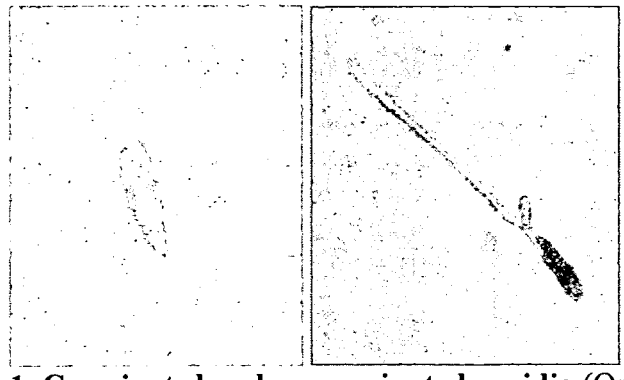

Figure 1. Germinated and ungerminated conidia (Original).

Germination rate was determined by proportioning the germinated conidia to the total conidia number. The data were evaluated by finding ED50 and MIC (Minimum Inhibition Concentration) values. ED50 values of fungicides were determined by using logarithmic charts. The trials were designed as four replications in random block trial design.

RESULTS AND DISCUSSION

The sensitivity of isolates to fungicides in *in vitro* trials according to ED_{50} values is presented in Table 1.

Table 1. Distribution of *V. inaequalis* isolates according to ED_{50} values (µg / ml).

Fungicide	Number of isolates	<0,001	0,001-0,003	0,003-0,01	0,01-0,03	0,03-0,1	0,1-0,3	0,3-1	1-3	3-10
Captan	20	0	0	0	7	12	1	0	0	0
Hexaconozole	20	0	0	0	6	13	1	0	0	0
Trifloxystrobin	20	0	0	0	12	8	0	0	0	0

A decrease was observed in the sensitivity of *V. inaequalis* to captan and hexaconazole according to ED_{50} values. *V. inaequalis* isolates were gathered in three groups in captan and hexaconazole according to ED_{50} values (0,01-0,03 µg/ml, 0,03-0,1 µg/ml and 0,1-0,3 µg/ml), while they were gathered in two groups in trifloxystrobin (0.01-0.03 µg/ml and 0.03-0.1 µg/ml) (Table 1). It was determined according to ED_{50} values that the sensitivity of isolates to captan and hexaconazole intensively used in apple gardens in the region was lower than their sensitivity to trifloxystrobin. It was especially considered remarkable that the same isolate has a similar sensitivity to both fungicides despite the absence of cross-resistance between them. While the previous studies had not reveal any reduction in the sensitivity of *V. inaequalis* to captan; it was found that different fungi, such as Botrytis cinerea, had decreased sensitivity to fungicides and that this decrease was permanent (DELEN ET AL., 1999; 2000). Some *V. inaequalis* isolates had higher concentrations according to ED_{50} values (0,03-0,1 µg/ml and 0,1-0,3 µg/ml), and this finding was associated with the possibility that the pathogen had developed resistance against captan used in the region for long years (Table 1). This decrease in sensitivity indicates that there may be individuals in the fungal population which have decreased sensitivity also to hexaconazole, a sterol biosynthesis inhibitor (SBI). In the study conducted with isolates obtained from Eğridir in the city of Isparta, it was determined that the pathogen's sensitivity to flusilazole and hexaconazole in Triazole group decreased (BENLIOĞLU AND KILIÇ, 1995).

On the other hand, the dose range of 8 isolates in trifloxystrobin was between 0,03 and 0,1 µg/ml according to ED_{50} values, and this finding indicates a resistance risk although the fungicide began to be used only recently in the region. KÖLLER ET AL. (2004) reported that cytochrome bound to Qol center in the fungal cell where trifloxystrobin and kresoxim-methyl was found and thus there was no resistance against the fungicides inhibiting respiration, yet the isolates of *V. inaequalis* obtained from the gardens where Qol's were intensively used has high resistance against both fungicides and these were the mutants of G143A cytochrome b. In the study conducted by OLAYA AND KÖLLER (1999) in 5 leasing apple growing regions in North America, they detected 25 different *V. inaequalis* populations against kresoxym-methyl which is in the same group as trifloxystrobilurin (QoI), and their baseline sensitivity values was found to be 0,35 µg/ml as ED_{50} value.

These previous studies indicate that resistant individuals may be found also in the apple gardens in Çanakkale region although *V. inaequalis* isolates have not developed resistance yet against trifloxystrobin in this location. The sensitivity of isolates to fungicides according to MIC (minimum inhibitory concentration) values is given in Table 2.

Table 2. Distribution of *Venturia inaequalis* isolates according to MIC values (µg / ml)

Fungicide	Number of isolates	<0,0 - 01	0,001-0,03	0,003-0,01	0,01-0,03	0,03-0,1	0,1-0,3	0,3-1	1-3	3-10
Captan	20	-	-	-	-	-	-	5	9	6
Hexaconozole	20	-	-	-	-	-	-	-	5	15
Trifloxystrobin	20	-	-	-	-	-	-	8	10	2

The isolates demonstrated a different distribution according to MIC (Minimum Inhibitory Concentration) values. The isolates formed 3 groups in captan and trifloxystrobin according to MIC values (0,3-1 µg/ml; 1-3 µg/ml; 3-10 µg/ml), and 2 groups in hexaconazole (1-3 µg ml; 3-10 µg/ml) (Table 2). While 6 isolates were completely inhibited against captan in the concentration rate of 3-10 µg / ml, 15 isolates in hexaconazole and 2 isolates in trifloxystrobin were inhibited in this dose range. A significant part of the isolates were found to have low sensitivities to hexaconazole in the SBI group according to MIC values. A similar decrease in sensitivity according to MIC values was observed against captan with 6 isolates, which is in the group of Trichloromethylthiocarboxamids and does not have a specific mode of action, and against trifloxystrobin in Qol group with only 2 isolates (Table 2).

CONCLUSIONS

The sensitivity of isolates to fungicides were observed to be higher when ED_{50} values were considered, but it was found to be lower according to MIC values, indicating that these isolates have different sensitivities to fungicides. This study also revealed that the isolates collected from Çanakkale region had similar sensitivities to captan in the group of Trichloromethylthiocarboxamids, hexaconazole in Triazole group, and trifloxystrobin in Stroblurin group.

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REFERENCES

BENLIOĞLU S., B. KILIÇ (1995): *Venturia inaequalis* (Cke.) Wint. Studies on the Sensitivity of Isolates to Flusilazole and Hexaconazole. 7th Turkish Pythopathology Congress, 26-29 September 1995, Adana. pp. 207-210.

DELEN N. (2008): Fungicides. p. 318, Nobel Publications, Ankara.
DELEN N., TOSUN N., YILMAZ O., YILDIZ Z. (2000): Variation in the sensitivities of *Botrytis cinerea* isolates to some fungicides with non-specific mode of action. International *Botrytis* Symposium, 3-7 July 2000, Reims, France. p.64.
FÄRBER R.B.K., CHIN K.M., LEADBITTER N. (2002): Sensitivity of Venturia inaequalis to Trifloxystrobin. Pest Management Science, 50 (3); 261-267.
KÖLLER W., PARKER D.M., TURECHEK W.W., AVILA-ADAME C. (2004): A Two-Phase Resistance Response of ***Venturia inaequalis*** Populations to the QoI Fungicides Kresoxim-Methyl and Trifloxystrobin. Plant Disease, 88(5): 537-544.
KÖLLER W., WILCOX W.F. (2001): Evidence for the Predisposition of Fungicide Resistant isolates of *Venturia inaequalis* to a Preferential Selection for Resistance to Other Fungicides. Phytopathology, 91(8): 776:781.
OLAYA G., KÖLLER W. (1999): Baseline sensitivities of *Venturia inaequalis* populations to the strobilurin fungicide kresoxim-methyl. Plant Dis. 83:274-278.
PALANI P.V., LALITAKUMARI D. (1999): Resistance of *Venturia inaequalis* to the Sterol Biosynthesis-Inhibiting Fungicide, penconazole [1-(2-(2,4-diclorophenyl) pentyl)-1H-1,2,4-triazole]. Mycol. Res., 103 (9); 1157-1164.
ROBERTS A.L., CRUTE I.R. (1994): Variation in Sensitivity to Fungicides among UK Isolates of *Venturia inaequalis*. In BCPC Monograph of Fungicide Resistance (ed. S. Heaney, D. Slawson, D.W. Hollomon, M. Smith, P.E. Russell and D.W. Parry), 107-110.
SHOLBERG P.L., HAAG P.D. (1993): Sensitivity of *Venturia inaequalis* Isolates from British Columbia to Flusilazole and Myclobutanil. Canadian Journal of Plant Pathology, 15, 102-106.
SMITH F.D., PARKER D.M., KOLLER W. (1991): Sensitivity Distribution of *Venturia inaequalis* to the Sterol Demethylation Inhibitor Flusilazole: Baseline Sensitivity and Implication for Resistance Monitoring. Phytopathology, 81, 392-396.
TÜRKOĞLU K. (1956): Studies on the Biology of *Fusicladium Dendriticum* Fungus Causing Damage in Konya-Ereğli Apples and Combat Facilities. The Turkish Ministry of Culture, Ankara Directorate of Agricultural Combat Institute, Vol. 6, Ankara, p. 135.

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BIOLOGICAL PRESERVATIVE IN WHOLE CROP WHEAT ENSILAGE

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ABSTRACT – Biological preservative in whole crop wheat ensilage
Ensilage of whole crop wheat is popular in Europe and America for feeding of ruminant animals, but it is quite rare in Hungary. It can be introduced for replacement of shortage of silomaize silages in drought season. The quality of wheat silage could improve by biological inoculants.
Silage additives are expected to ensure a more efficient fermentation phase as well as reduce the risk of aerobic deterioration when silages are exposed to air. Many additives have been developed to improve the ensiling process and nutritive value of silage.
Nowadays the 3rd generation biological inoculants –containing lactic acid bacteria and enzymes – are used in order to coordinate the fermentation in such a way that they increase lactic acid production at the beginning of the fermentation and improve the quality and stability of silage during the fermentation and feeding. The quality of raw material (maturity of plant, chop length, spreading of inoculant uniformly) and the proper filling, compacting, covering and wrapping have a great influence on the effectiveness of the inoculant. The mycotoxin content of malfermented silages is an undesirable risk factor.
The objective of our research was to determine the effect of two silage inoculant strains *Lactobacillus buchneri* and *Pediococcus acidilactici* mixture combined with *amilase-, glucanase-, xylanase* and *galactomannase* enzymes on whole crop wheat silage fermentation characteristics, nutritive value and aerobic stability compare to untreated control.
Experimental ensilage procedure started with the basic whole crop raw material originated from waxen ripeness of wheat (hard cheddar stage of maturity of seeds) at the time of harvesting. The DM content of chopped raw material was 44%.
The LAB inoculants were applied to raw material at $2.5x10^5$ CFU/g fresh material (FM).
Because of quite good quality of untreated silages also, the priority of LAB treatment could not proven in the aerobic stability test. The biological preservative (LAB+enzymes) promoted better fermentation and forced back the undesirable butyric acid production in the silages.

Keywords: whole crop wheat silage, lactic acid bacteria, fermentation, aerobic stability

INTRODUCTION

Wheat is used for bread-stuffs first of all, or for animal feed. Ensilage of whole crop wheat is popular in Europe and America (WOOLFORD ET AL., 1982), but very rare in Hungary until now. The reason of making whole crop wheat silage for ruminant animals is the following: The uncertainty of selling of over production could be avoided in the high yield years. The wheat harvesting is occurred 2-2,5 months earlier than for maize means: whole crop wheat silage is available the same time earlier, so it could be replace the shortage of other forages at that time. Early entry of reseeds is possible. There is no environmental pollutant effluent. Lower clamp cost, eg. straw ball walls are sufficient.

Additives are expected to ensure a more efficient fermentation phase as well as reduce the risk of aerobic deterioration when silages are exposed to air (KEADY AND MURPHY, 1998, SZUCS AND SINDOU, 2005). Many additives have been developed to improve the ensiling process and nutritive value of silages (NIA AND WITTEMBER, 1999, KUNG ET AL., 2003).

Acids: under difficult ensiling conditions (rainy weather) acids are best choice as an aid to preservation. *Enzymes:* additives containing fibriolytic enzymes provide additional sugar through the breakdown of plant fibre. *Bacterial inoculants:* they can improve fermentation characteristics by speeding up the fall in pH and lowering ammonia levels into the silo. At present biological additives are preferred because they are non-toxic, non-corrosive to machinery, do not present environmental hazards and are regarded as natural products.

Mixtures of different types of additives: they can improve the effect of usage them selves. Nowadays the *bacterial inoculants* with cell-wall degrading *enzymes* -so called 3rd generation biological inoculants- one of the most popular additives are used in order to coordinate the fermentation in such a way that they increase lactic acid production by leaps and bounds at the beginning of the fermentation and improve the quality and stability of silage during the fermentation and feeding (KUNG ET AL., 1991).

There is an unsettled discussion around this issue: the circumstances provided in the silo do not always fit the optimal conditions which are necessary for the functioning of the enzymes. For example cellulase originating from *Trichoderma reseei* fungi, has an optimal activity between pH 4.8 and 5.2 while from *Trichoderma viride* is between 4 and 5. The optimal temperature for these cellulase enzymes: namely 55-65 °C and 40-50 °C respectively (KNABE, 1987). We need to make a compromise regarding the maturity and dry matter content of plant for ensiling as well. The suggested domain of dry matter content for ensiling of grass and lucerne is 28-33% (SCHMIDT ET AL., 2001) as the hard cheddar/ wax maturity of cereals (SZUCS AND AVASI, 2005), in which domain both lactic acid bacteria and cell wall degrading enzymes can work in a sufficient manner.

Silage additives produce variable results on aerobic deterioration of silages. A high concentration of lactic acid cannot provide aerobic stability for sure SUCU AND FILYA (2006). Recently the heterofermentative *L. buchneri* is regarded to be the most promising lactic acid bacteria for increasing aerob stability (DREIHUIS ET AL., 1996, 1999, WEINBERG ET AL., 2002). Applied by itself it may show a negative effect by reducing the speed of fermentation, but its combination with homofermentative lactic acid bacteria does compensate this disadvantage (FILYA, 2003).

According to RUSER AND KLEIMAN (2005) it takes effect on stability in the 2nd phase: during the 1st phase lactic acid originates from sugar and in the 2nd phase acetic acid and 1,2 propandiol are generated from lactic acid. OUDE ELFERINK ET AL. (1999) emphasize the role of propionic acid originating from 1,2 propandiol and 1 propanol in stability (1,2 propandiol and 1 propanol are not found in untreated silage). *L.buchneri* may produce other yet unindentified metabolites with antifungal activity BAX AND SINDOU (2005). Applying suitable biological preservatives may be an effective method for the promotion of lactic acid fermentation and preserving forage nutritive value during ensiling and on exposure to air at feed-out (WEDDEL, 2001).

The quality of raw material for ensilage (maturity of plant, chop length, spreading of inoculant uniformly) and the proper filling, compacting, covering and wrapping have a great influence on the effectiveness of the inoculant. The mycotoxin content of malfermented silages is undesirable risk factor (NADEU, 2007, SZUCS –AVASI, 2005).

MATERIAL AND METHODS

Table 1. Composition of applied biological (LAB+ enzymes) inoculant

Lactobacillus buchneri NCIMB 40788	> 3.00 x 10^{10} CFU* /g
Pediococcus acidilactici MA 18/5M	> 2.00 x 10^{10} CFU /g
Beta-glucanase	> 6000 IU/**g
Alfa-amilase	> 2400 IU/g
Xylanase	> 2400 IU/g
Galactomannase	> 1200 IU/g

**Colony Forming Unit* ***Activity Unit*

Treatments

- T1: Control (untreated) for 4 weeks storage
- T2: LAB inoculants 2.5x10^5 CFU/g fresh material (FM) for 4 weeks storage
- T3: Control (untreated) for 6 weeks storage
- T4: LAB inoculants 2.5x10^5 CFU/g fresh material (FM) for 6 weeks

The certain amounts of inoculants (*Table 1.*) were diluted in 100ml of distilled water, and spread on 25 kg of raw materials as follows:
We evenly spread 25 kg/treatment of chopped whole crop wheat on micro-silo ensiling on plastic foil, then we vaporized the silage additive on the weighed portions, finally it was mixed.

Micro-size ensiling process
Small size containers (4.2 l cubic capacity / each), which we used were closed by screwed cap. We filled 5 containers for each treatment, altogether 20 pieces. Storage took place on 20-22C° interior temperature. We stored the filled micro containers 4 or 6 weeks. We performed laboratory examinations on them. The examination focused primarily on the products of fermentation and the aerobic stability.

Chemical analysis
Dry matter (MSZ ISO 6496; 2001)
Crude protein with Kjehl-Foss technique on Gerhard Vapodest 40 types of equipment (MSZ 6830-4; 1981)
Crude fat: Soxhlet system (MSZ 6830-6; 1981
Crude fiber: Henneberg Stohmann system (MSZ EN ISO 6865; 2001)
NDF, ADF, ADL: Van Soest system (1967)
Crude ash: sample burning on 600 Celsius° (MSZ ISO 5984; 1992)
Examination of pH: used electric Digital pH Meter OP-211/1
Examination of NH_3: We measured NH_3 from watery extract, with OP264/1 NH_3 measuring device
Organic acids: lactic acid and volatile fatty acids (acetic-, butyric-, propionic acid) with the type of Young Lin 6100 Acme 6100 gaschromatograph device, applied FID detection. The type of directing softwere Autochro 3000.
Examination of ethanol: We determined it from watery extract with $K_2Cr_2O_7$ solution and through titration with Mohr-salt-solution.

Water soluble carbohydrates(WSC)system:D.Hillegis-G.Pahlow, FAL Braunscweig, Germany

Determination of aerobic stability – System Völkenrode (Honig, 1990)
Principle: To determine aerobic stability of the silages a method by Honig (1990) was modified and implemented. It is based on monitoring temperature wich rises due to increased microbial activity of samples exposed to air. The measurement was continued for 7 days. The registration of the temperature of the samples was realized in every hour by computer.
Evaluation: The time till that the silage is supposed to be stable is the registration unit shows a temperature rise of 3°C above ambient temperature (last at least 48 h).

Statistical analyses:
Full statistical analyse was using an internationally recognised statistical procedure.
We processed data by means of IBM PC computer with the aid of Microsoft Excel program. As method of mathematical statistics, we used the method of comparison of calculated mean values and significance. Significance was declared for $P<0.05$.

RESULTS

The most important characteristics of whole crop wheat and silages are shown in *table 2 and 3.*

Table 2. Chemical composition and nutritive value of whole crop wheat and silages

Parameters		Fresh raw material	Silages			
			4 weeks storage		6 weeks storage	
			Control T1	Treated T2	Control T3	Treated T4
		Mean n=5	Mean n=5	Mean n=5	Mean n=5	Mean n=5
Dry matter	**%**	43.7	45.7	45.9	45.6	45.2
Crude protein	**g/kg DM**	89	81	80	79	78
MPE	**g/kg DM**	71	66	66	65	65
MPN	**g/kg DM**	53	49	48	47	47
Crude fat	**g/kg DM**	26	18	15	18	20
Crude fibre	**g/kg DM**	392	314	321	324	327
Crude ash	**g/kg DM**	69	61	59	67	65
NE(m)	**MJ/kg DM**	5.56	5.31	5.27	5.23	5.27
NE(g)	**MJ/kg DM**	3.14	2.92	2.89	2.85	2.89
NE(l)	**MJ/kg DM**	5.22	5.19	5.17	5.13	5.15
WSC	**g/kg DM**	72	26	23	26	29
NDF	**g/kg DM**	743	615	611	633	620
ADF	**g/kg DM**	408	319	334	336	338
ADL	**g/kg DM**	68	68	73	66	61
Cellulose	**g/kg DM**	340	251	261	270	277
Hemicellulose	**g/kg DM**	335	296	276	297	282

Table 3. Fermentation products in whole crop wheat silages

Parameters		Fresh raw material	Silages			
			4 weeks storage		6 weeks storage	
			Control T1	Treated T2	Control T3	Treated T4
		Mean n=5	Mean n=5	Mean n=5	Mean n=5	Mean n=5
Dry matter	**%**	43.7	45.7	45.9	45.6	45.2
Buffer capacity		15	--	--	--	--
Lactic acid	**% of DM**	--	12.5	20.5	12.3	13.7
Acetic acid	**% of DM**	--	3.3	9.5	3.0	9.0
Butyric acid	**% of DM**	--	4.8	2.5	4.3	1.5
Propionic acid	**% of DM**	--	0.0	0.3	0.0	0.6
Ethanol	**% of DM**	--	1.2	1.1	0.9	1.5
Ammonia	**% of total N**	--	8.3	7.2	8.1	7.4
pH		--	4.1	4.1	4.1	4.2

CONCLUSIONS

The conclusion of whole crop wheat ensiling experiments-are the followings:
-The basic whole crop raw material originated from waxen ripeness of wheat (hard cheddar stage of maturity of seeds) at the time of harvesting. The DM content of chopped raw material was 44%.
-The average net weight of filled micro silo-containers was 1878-1882 g, the density of silos was 0,442-0,443 t /m^3 which corresponds to a density of 194 kg DM/m^3 .
The statistical analyse confirmed the similar density of the microsilos. There was no significant difference (P>10%) among the density of different treated microsilos.
-The average pH at silo opening was 4,1-4,2 suggesting that the treated and also untreated silages were well fermented.
-There was no significant effect of treatments on water soluble carbohydrate, protein- and netto energy content of silages .
-Lactic acid and acetic acid were the main fermentation products. High concentrations of acetic acid were found in the treated silages, indicating a hetero fermentative pathway thanks to the activity of *Lactobacillus buchneri.*
-There were significant differences between higher lactic acid content of treated silages and the the control after 4 weeks of fermentation (P< 5%) but there were no significant differences on 6 weeks samples.
-Lactic acid and acetic acid ratio was better in treated silages, which results better palatability and consumption for ruminant animals.
-The inoculant-treated silages contained less undesirable butyric acid than that of control silages. The difference is significant (P< 5) after 6 weeks of storage. The butyric acid is an undesirable substance of silages, because it is dangerous for the health of ruminant animals.
-The protein degradation was higher in control silages which was showed by their higher NH_3 content.
-On aerobic condition neither treated nor control silages did not heat up more than 3 C° during 7 days of exposure to the air.

-DM losses in bacterial treated silages were lower compare to the control -both after 4 and 6 weeks storage silages- during aerobic stability experiment, but the difference was not significant.
-Because of the same good stability of untreated silages, the advantages of LAB treatment could not proven by the aerobic stability test.
-The applied dosage of biological preservative (LAB+enzymes) promoted better fermentation and forced back the undesirable butyric acid production in the silages.

REFERENCES

DREIHUIS, F - SPOELSTRA, S.F. - COLE, C.C.J. - MORGAN, R. (1996): Improving aerobic stability by inoculation with Lactobacillus buchneri Proc. XIth International Silage Conference. IGER Aberystwyth, Wales 106-107

DREIHUIS, F. - OUDE ELFERINK S.J.W.H. - VAN WIKSELAAR, P.G. (1999): Lactobacillus buchneri improves aerobic stability of laboratory and farm scale whole crop maize silage but does not affect feed intake and milk production of dairy cows. Proc. XIIth International Silage Conference. Uppsala, Sweden. 264-265

FILYA, I. (2003): The effects of Lactobacillus buchneri with or without homofermentative lactic acid bacteria ont he fermentation, aerobic stability and rumen degreeability of wheat, sorghum and maize silages Journal of Applied Microbiology 95.5.1080-1086

Keady, T. W. J., Murphy J.J. (1998) Effects of inoculant treatment on silage fermentation, digestibility, rumen fermentation, intake and performance of lactating diary cattle. Grass and Forage Sci. 51:232-241

KNABE, O. (1987): Ermittlung von Einflussfaktoren zur Dynamik der Kohlenhydretfraktion in Grünfutterstoffen und Erschliessung biotechnologischer Prinzipien und von Silierhilfsmitteln zur Steuerung von Konservierungsprocessen. (Studie) Institut für Futterproduktion-Paulinaue

KUNG, L. - TUNG, R.S. - YACIOROWSKI, K.O. - BUFFY, K. - KNUTSEN, K. - AIMUTIS, W.R. (1991): Effects of plant cell-wall-degrading enzymes and lactic acid bacteria on silage fermentation and composition. Journal of Dairy Science, 74. 4284-4296

KUNG, L.- STOKES, M.R. - LIN, C.J. (2003): Silage additives In:Buxton, D.R.- Muck, R.E.- HARRISON, J.H. (eds.) Agronomy series No.42. Silage Science and Technology. Madison, Wisconsin, 305-360.

NADEU, E. (2007): Effect of plant species, stage of maturity and additive on feeding value of whole crop cereal silage Journal of the Science of Food and Agriculture, 87. 5. 789-801

NIA, S.A.M. - WITTENBERG, K.M. (1999): Use of forage inoculants with or without ensymes to improve preservation and quality of whole crop barley forage Canadian Journal of Animal Science, 79.4. 525-542

OUDE ELFERINK S. J.W.H., DRIEHUIS, F., KROONEMAN, J., GOTTSCHAL, J. C., SPOELSTRA, S.F. (1999): Lactobacillus can improve the aerobic stability of silage via a novel fermentation pathwas: the anaerobic deterioration of lactic acid to acetic acid and 1,2 propanediol. Proc. XIIth Int. Silage Conf., Uppsala, Sweden pp. 266-267.

RUSER, B., KLEIMAN, J. (2005): The effect of acetic acid on the aerobic stability of silages and on intake Proc. XIVth International Silage Conference. Belfast Northern Ireland, pp. 231

SCHMIDT, J., CSERMELY, J. ,SZŰCSNÉ PÉTER, J., BELLUS, Z. , SIPŐCZ, J. (2001): Conservation of green lucerne by biological conserves containing cell-wall degrading enzymes 52. Annual Meeting of EAAP Paper N6

SUCU, E. - FILYA, I. (2006): The effects of bacterial inoculants on the fermentation, aerobic stability and rumen degredability characteristics of wheat silages Turkis Yournal of Veterinary Animal Science 30.187-193

SZUCS, J.P.-SINDOU J. (2005): New inoculant protects alfalfa's properties Feed-Mix 13.3.13-15

SZUCS, J.P. - AVASI, Z. (2005): Amit a jó szilázs készítéséhez tudni kell. Szoliter Nyomda Hódmezővásárhely, 1-96

WEDDELL, J.R. (2001): Silage Additive Approval Schemes in Europe – Aims, Developments and Benefits Proceedings of X. International Forage Conservation, Brno, 37-44

WEINBERG, Z.G.-ASHBELL, G.-HEN, Y.AZRIELI, A.-SZAKACS, G.-FIYLA,I. (2002): Ensiling whole –crop wheat and corn in large containers with Lactobacillus plantarum and Lactobacillus buchneri Journal of Industrial Microbiology and Biotechnology 28.1.7-11

WOOLFORD, M.K. – BOLSEN, K.K. – PEART, L.A. (1982): Studies on the aerobic deterioration of whole-crop cereal silages. Journal of Agricultural Science, 98. 529-533

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STATISTICAL OVERVIEW OF EMPLOYMENT BY ECONOMIC ACTIVITY AND PROFESSIONAL STATUS IN EU

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ABSTRACT – Statistical overview of employment activity and professional status in EU 27
RuralJobs is a collaborative research project partly funded under the European Commission Research and Development 7th Framework Program (FP7). It involves partner institutions from eight Member States. University of Debrecen is the coordinator. RuralJobs quantifies labour market, demographic and economic trends, and the impact of employment creation measures and policies in six, representative "reference areas" across the EU, and uses the information to demonstrate how rural development measures can be better targeted and how rural development policies should evolve. The Eurostat database was chosen as the main source of information for statistical analysis. Taking into account rurality the regions were divided into three groups: predominantly urban regions (PU), intermediate regions (IR) and predominantly rural regions (PR). Knowing the employment characteristics in EU regions contribute to common understanding of the processes on the labour market that is the basis of the formulation of new, efficient strategies of employment. Tendencies of employment by economic activity and profession features are analysed to initiate suggestions of employment development.

Keywords: employment, self-employment, family worker, age group, sector

INTRODUCTION

There are many preconditions of employment development. Labour market mobility was greatly related to institutional developments in Great Britain for two decades previous to 2002 nevertheless employment had been increasingly tied to economic development (HILLMERT, 2002). Studying the regions of the EU to compare the employment of economically advanced and underdeveloped areas similar conclusion can be drown since prosperous regions have higher employment status than economically stranded areas.
FALZONE (2000) states part time employment as a transition between non-employment and full-time employment or as an alternative to full employment. Part time employment can be a viable solution for married women with young children to build a carrier and to be a devoted family member.
Women's employment is becoming growingly important the reason is not only to reach the desirable equal work – equal payment idea but there are many practical issues as well that force females to be employed. HOLST AND SCHUPP (2001) found that employment of women in Germany has become more important recently because of more single-person households and high divorce rates. Even in married-couple households women's earning is a significant part of the family budget in many German families. It was difficult for women to get a job in the well developed Western regions but the situation was "persistently precarious" for women of economically less developed Eastern regions.
Part time employment can be a necessity for many groups of people who can not undertake full employment. In the USA APPELBAUM (2003) diagnosed the following reasons to have

a part time job: to create balance between work and personal life, young couples can not leave on one income, baby-boomers responsibility for young children and ageing parents, and increased investment for retirement. According to the study increasing number of American people wants work in good-quality part-time jobs. Appelbaum criticises the lack of public policies that back up high-quality, part-time employment and the existing situation where part time employees depend on the goodwill of the employer and in reality part time employees are in a much worse position than their full time associates.

Many research results have established that employment pattern is changing through age groups and gender. Employment rates of youth and elderly are lower than the employment rate of prime-aged people. Employment rate of prime-aged women is generally lower than employment rate of prime-aged men. Examining labour market institutions and demographic employment patterns using data from 17 OECD countries BERTOLA ET AL. (2007) found that the above mentioned labour market pattern was affected by unionization. They stated that unionization increased the differences in employment ratios amongst the age groups and between men and women.

In many European countries subsidised employment is a mean to increase the number of working population however exact researches to investigate the results of this kind of programmes are rare. In the Netherlands subsidised employment programmes were highly promoted by the policy in the decade of pre-2003. According to the research of JONGEN ET AL. (2003) employment subsidies made a little positive effect on the employment in the private sector and a more positive effect on the employment in the public sector increasing the employment in both sectors. However because the big number of regular employment leavers, overall employment decreased. The research team remarked that the effect of employment subsidies on aggregate and individual level can be quite different and the fast growing expenditures on employment subsidies necessitate the promotion of empirical researches of this area.

A specific type of employment is the Australian causal employment where the employee receives a significantly higher income than a permanent full time employee but causal workers lack the benefits. This type of employment is often a transition stage between unemployment and permanent full-time employment and it is a flexible form of employment. Despite the advantages various sources of insecurities are involved in the causal employment system that should be reduced (BURGESS ET AL. 2008).

In rural areas small businesses may be a plausible solution of employment growth. Taking samples of more than 2000 counties in the USA SHAFFER (2006) established that the smaller the average size of a business the faster the growth rate of sectoral employment. Because of the significance of small businesses on the economy understanding the way how small businesses affect labour market in a region can be an important step toward job creation.

MASI ET AL. (2003) conducted a research in a low income community searching the efficiency of Internet training educating people to acquire health information via home internet. They proved that group members receiving Internet training changed their attitudes toward the Internet technology and their affinity to used Internet increased significantly. The research suggests that short course courses are good tools to increase interest in IT in people who have not used Internet.

METHODOLOGY

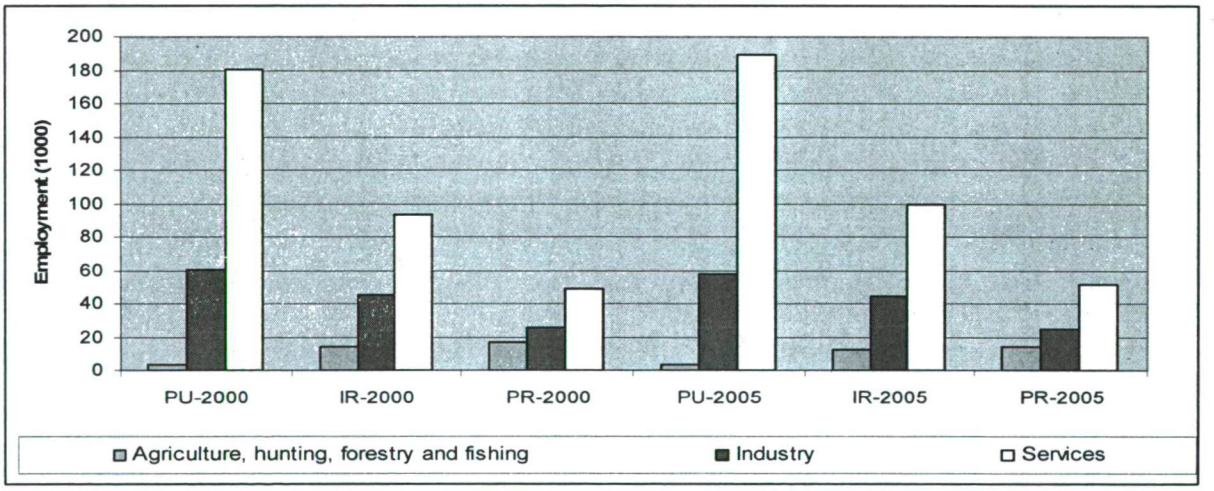
The Eurostat database was chosen as the main source of information for statistical analysis. When the data base was selected the following considerations were important: availability

of data for all the EU 27 countries on national and regional (NUTS2 and NUTS3) level. The examined time period was from 2000 to 2006, the end was determined by the availability of data on the Eurostat database. Tendencies were evaluated by comparing the data of the first year and the last year of the examined period. Taking into account rurality the regions were divided into three groups: predominantly urban regions (PU), intermediate regions (IR) and predominantly rural regions (PR). The categorisation of rurality based on the methodology of the Organisation for Economic Co-operation and Development which method uses population density as the criteria of rurality.

RESULTS

The aim of the EU is to employ each EU citizen who would like to participate in the labour market and to reach the 70% percent employment rate by 2010. Knowing the employment characteristics in EU regions contribute to common understanding of the processes on the work market that is the basis of the formulation of new, efficient strategies of employment.

Table 1 Total Employment, EU 27, at NUTS levels 3, average of PU, IR and PR regions

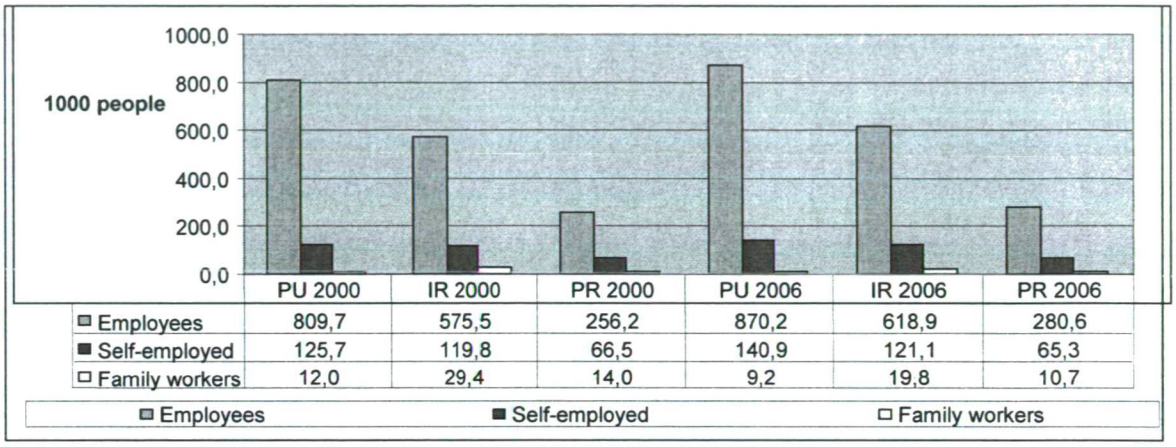


Source: Eurostat General and regional statistics, 2000, 2005

Employment in agriculture, hunting, forestry and fishing was the lowest in PU regions, more people was employed in IR regions and the higher number of inhabitants was employed in PR regions in the EU *(Table 1).* Employment in the industry and services showed an opposite tendency than employment in agriculture, hunting, forestry and fishing since the most people were employed in PU regions and the smallest number of employees worked in PR regions. The structure of economic activity was different in an average PU, IR and PR region. Comparing the ratio of employment in services, in agriculture, hunting, forestry and fishing and in industry it was found that the ratio of people employed in services PU or IR regions was significantly higher than it was in PR regions. This huge difference in employment in services suggests that rural people's access to various services is very limited in comparison with the possibilities of inhabitants in PU and IR areas which is an important disadvantage of the rural life. Enhanced service activities may directly increase the employment and may provide a more attractive situation in rural regions

In the Eurostat general and regional database, in the section of employment by professional status, the employment is equal with the sum of employees, self-employed and family workers.

Table 2 Employment by professional status NUTS 2 (1000)

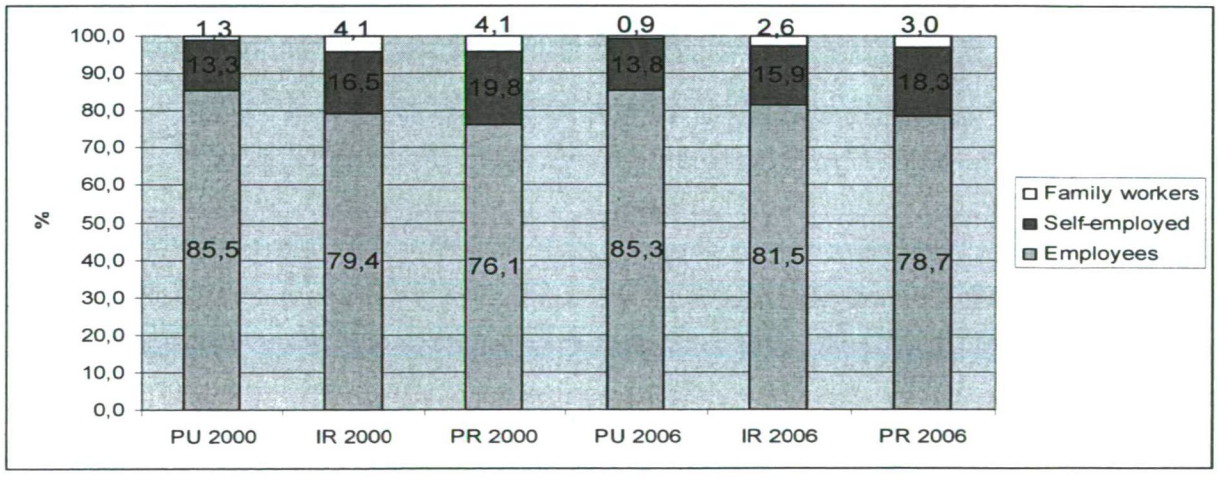


	PU 2000	IR 2000	PR 2000	PU 2006	IR 2006	PR 2006
Employees	809,7	575,5	256,2	870,2	618,9	280,6
Self-employed	125,7	119,8	66,5	140,9	121,1	65,3
Family workers	12,0	29,4	14,0	9,2	19,8	10,7

Source: Eurostat General and regional statistics, 2000, 2006

Analysing the employment by professional status it can be seen that the decisive part of people worked as employees and far more people were self-employed and the number of family members was significantly the lowest *(Table 2).*

Table 3 Employment by professional status NUTS 2, 2006



Source: Eurostat General and regional statistics, 2000, 2006

The structure of employment was different in urban and rural areas of the EU *(Table 3).* The ratio of employees was the highest in PU regions (85.29%) and the lowest in PR regions (78.70%) in 2006. The ratio of self-employed people and family workers showed

an opposite tendency with low ratios in urban and higher ratios in rural areas. The rate of family workers was about three times more In IR and PR regions then in PU regions.

Table 4 Employment by professional status NUTS 2 (%), 2000-2006

Professional status	2000-2006		
	%		
	PU	IR	PR
Employees	7.47	7.55	9.49
Self-employed	12.05	1.08	-1.84
Family workers	-23.64	-32.59	-23.66

Source: Eurostat General and regional statistics, 2000, 2006

The number of employees increased notably in PU (7.47%), IR (7.55%) and in PR (9.49%) regions from 2000 to 2006 *(Table 4).* The development of self-employment was intensive in PU regions (12.05%) however small changes were experienced in IR (1.08%) and in PR (-1.84%). The low number of family workers diminished greatly in each region type (23.64%-32.59%).

Table 5 Employment by highest level of education attained NUTS2 (1000) between 25 and 64 years, 2000-2006

Between 25 and 64 years	PU	IR	PR
Pre-primary, primary and lower secondary level	8,17	0,77	-9,81
Upper secondary and post-secondary non-tertiary education - level	9,51	10,68	11,22
Tertiary education level	25,54	27,16	32,55

Source: Eurostat General and regional statistics, 2000, 2006

The level of education increased generally from 2000 to 2006 since the ratio of employees with tertiary education grew most intensively in PU, IR, and PR regions by 25.54-32.55%, the ratio of employees with upper secondary and post-secondary non-tertiary education improved less intensively by 9.51-11.22%, and the ratio of employees with Pre-primary, primary and lower secondary education increased by 8.17%, in PU regions, by 0.77% in IR regions and decreased by 9.81% in PR regions *(Table 5).* The most significant improvement in the level of education was found in predominantly rural areas which indicates that the demand increased for the people with higher education in rural regions.

Table 6 Employment rates by age, at NUTS 2 (%)

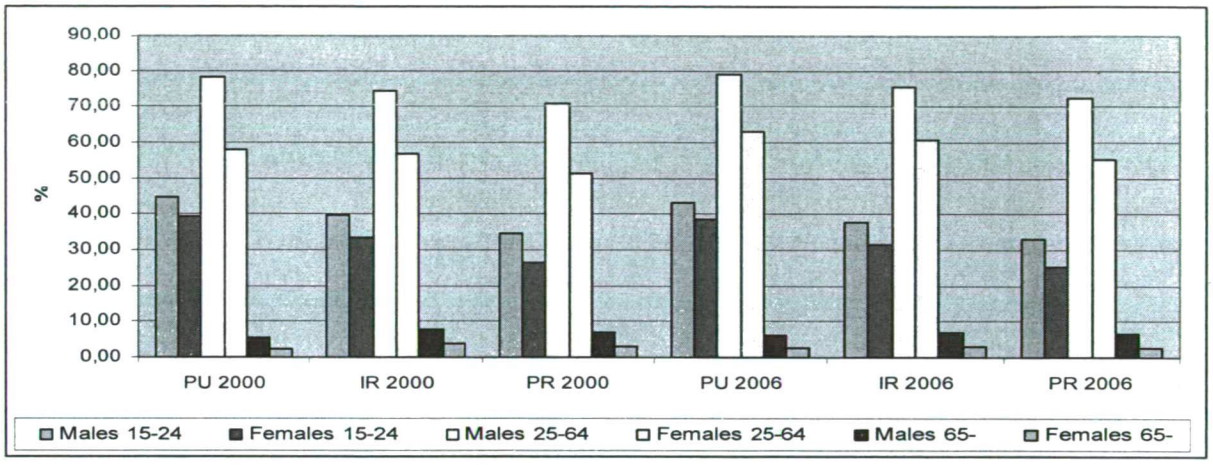
	PU	IR	PR
Age groups	%		
Between 15 and 24 years	-2,69	-5,48	-3,54
25 - 64	4,21	3,67	4,67

65 years and over	20,92	-14,21	-7,25

Source: Eurostat General and regional statistics, 2000, 2006

The employment rates of age group of 25-64 increased in all region types from 3.67% (IR) to 4.67% (PR) *(Table 6).* The employment rate of the age group of 15-24 was lower than the employment rate of the age group of 25-64 in 2000 the gap between the two groups increased during the examined time period. The employment rates of the oldest age group decreased also in IR (14.21%) and PR (7.25%) regions but it increased notably by 20.92% in PU regions.

Table 7 Employment rates by sex and age NUTS 2 (%)



Source: Eurostat General and regional statistics, 2000, 2006

The order of employment rates by age groups was similar in both genders (Table 7). The lowest employment rates were in the age group of 65 and over and the highest employment rates were in age group of 25-64. The employment rates of both genders were higher in urban areas than rural areas in the decisive age groups of 15-24 and 25 -64. Employment pattern is changing through age groups and gender. Employment rates of youth and elderly are lower than the employment rate of prime-aged people.

CONCLUSIONS

Economic development affects the employment level in many ways. In geographically less favourable areas parents invests less in the education of their children that results in a less educated population of these regions that increases the gap between developed and underdeveloped areas. The most significant improvement in the level of education was found in predominantly rural areas which indicate that the demand increased for the people with higher education in rural regions. Employment needs of the working age population differ greatly depending on the status of the person. European regions face the consequences of rapid and unequal development of the service sector. Further decrease of employment in agriculture changes rapidly the structure of employment in rural areas. Employment in agriculture, hunting, forestry and fishing decreased greatly in PU, IR and PR regions of the EU the most significant decline happened in PR regions.

REFERENCES

APPELBAUM, E. (2003): Company Practices: A Barrier to Good-quality Part-time Employment in the U.S. Economic Bulletin, Volume 40, Number 10 / October, p. 333-340

BERTOLA, G., BLAU, F. D. AND KAHN, L. M. (2007): Labor market institutions and demographic employment patterns Journal of Population Economics, Volume 20, Number 4 / October, p. 833-867

BURGESS, J., CAMPBELL, I. AND MAY, R. (2008): Pathways from Casual Employment to Economic Security: the Australian Experience Social Indicators Research, Volume 88, Number 1 / August, p. 161-178

FALZONE, J. S. (2000): Labor market decisions of married women: With emphasis on part-time employment International Advances in Economic Research, Volume 6, Number 4 / November, p. 662-671

HOLST, E. AND SCHUPP, J. (2001): Employment Behavior Among Women in Germany: Differences between East and West Persist Economic Bulletin, Volume 38, Number 11 / November, p. 377-384

Hillmert, S. (2002): Deregulation of the labor market and chances of employment in Great Britain , International Advances in Economic Research, Volume 8, Number 1 / February, p.1-9

JONGEN E.L.W., VAN GAMEREN, E. AND GRAAFLAND, J. J. (2003): Exploring the Macroeconomic Impact of Subsidized Employment De Economist, Volume 151, Number 1 / March, p. 81-118

MASI, C. M., SUAREZ-BALCAZAR, Y., CASSEY, M. Z., KINNEY, L. AND PIOTROWSKI, Z. H. (2003): Internet access and empowerment , A community-based health initiative Journal of General Internal Medicine, Volume 18, Number 7 / July, p. 525-530

SHAFFER, S. (2006): Establishment Size and Local Employment Growth Small Business Economics, Volume 26, Number 5 / June, p. 439-454

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ORGANIC ANIMAL BREEDING AND PRODUCTION, QUALITY ASSESSMENT OF RAW MATERIALS AND PRODUCTS

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Abstract - Organic animal breeding and production; quality assessment of raw materials and products
There is an increased need for the products of ecological/organic animal breeding origin (products from agro-units with ecological qualification or units to go organic). I present the analysing processes and the quality preferences concerning human nutrition. They are dealing with the protection of origin, prevention of adulteration and food safety questions. Furthermore they present examples for the advantages of indigenous, traditional breeds used in the organic production.

Keywords: organic animal breeding, traditional animal races, eco products, direct marketing, human nutrition

INTRODUCTION

The statistical data of organic animal breeding shows an increased consumer need for safe and healthy food of animal original. In EU countries this is a general tendency; we will deal with the situation of Central-European countries. We will talk about the qualified farms and those which are under changing conditions, because their eco-production is also very important.
Claim for plant production, environment protection, sustainable agriculture, rural developing and ecological animal keeping are increasing in Hungary (PONGRÁCZNÉ AND MEZEI, 2008; PONGRÁCZNÉ 2008, PONGRÁCZNÉ ET AL., 2009, (PONGRÁCZNÉ AND CSURGÓ, 2010)), and National Park Directors show special ecological model picture for the members of green agriculture in Hungary. Generally national parks have native the standing animals. Generally animals in general national parks are keeping because of model for pasture feeding (ÁNGYÁN ET AL., 2002; ARADI, 1992; VERESS ET AL, 2000; VERESS, 1987).

MATERIALS AND METHODS

The controlled eco production in Hungary has a past of more than ten years. *Table 1.* shows the data of animal farms considering the data of two control units. There are 134 farms under changing conditions (changing into eco production), with a number of 16.430 standard animals. The animal species involved in eco production are also presented in *Table 1.*
The present situation is not so hopeful; this can be seen from the data of BIOFACH 2008 exposition, Nürnberg, Germany where 2.740 exhibitors were present; 7% more than in 2007, but only 27 from Hungary. One of them presented organic honey, and the Hortobágy Non-profit Company for Nature Conservation and Gene Preservation (shortly: Hortobágy

Co.) presented several different raw materials and products with eco qualification. This company has a leading role on the Hungarian organic market (see: *table 2.*). The Hortobágy Co. has an adequate stock of products for a continuous market supply, too.

Table 1. Number of standard animals of Hungarian farms in (2007)

Animal species	Nr. of standard animals
Poultry	188,5
Buffalo	539,2
Sheep	1.256
Goat	304,3
Horse	229,9
Pig	830,5
Donkey	35,2
Cattle	13.046
Total	**16.430**

Source: Biokontroll Hungaria Kht.

Table 2. Hortobágy Company's organic raw materials and products

Animal species	Raw materials	Products
Gray cattle	Meat, pluck (liver, triple 12 different packaging)	Eco salami
Buffalo	Meat (in 8 different packages)	Spicy/Hot Buffalo salami
Mangalitza pig	Meat, pluck (lungs, heart, fat in 14 different packages)	Organic sausage, smoked bacon, salted bacon
Racka sheep	Meat	Eco salami
Guinea fowl	Meat, eggs	-

The animal farms under changing conditions are also very important from ecological point of view. The two main farms from Hungary are: 1) Family Farm of Csöde, Western-Hungary and 2) Tiszaug Farm, Middle-Hungary. The first one has a territory of 220 hectares and the second one 15 hectares with a number of 18 standard animals (poultry: more than 3.000 hens, ducks, geese and mangalitza pigs). The farms under changing conditions can also increase the contribution to the total national eco animal breeding. *Table 3.* shows the data regarding the organic animal breeding in some Central-European countries (Hungary, Romania, Austria, Germany).

The authors are in a good cooperation, regarding the production with some eco producer companies from the above mentioned countries: SANFER, LA DORNA and GORDON PROD companies from Romania; Cattle Breeding Federation from Southern-Austria; Agrobiogen Ltd. and Animal Breeding Authority from Germany.

RESULTS AND DISCUSSIONS

From *Table 3.* can be seen, that the data from Germany and Austria are examples to be followed by us. In Germany the direct ("ab Hof") marketing data are also good examples to follow. The 21% directly marketed products might be a pulling force for our farms, too – if they would get some governmental support (see *table 4.*).

Table 3. Some data of eco animal breeding in Central-Europe (Hungary, Romania, Austria and Germany)

Country	Eco territory *ha*	Nr. of eco farms	Nr. of animal species	Nr. of animals ×1000	Nr. of control units	Products	Quantities
Hungary	160000	1600	5	na	2	meat, milk, egg, honey	na
Romania	200000	na	4	na	1	meat, milk, egg, honey	62000 (export 2006)
Austria	362000	20500	5	840 hen 45 cow 44 pig	1	meat, milk, egg, honey, chocolates	110mil. eggs 398mil.kg butter
Germany	800000	16500	5	na	8	meat, milk, egg, cheese, butter	40%-of the products

Source: no available data

Table 4. The animal breeding capacity in Hungary

Pasture methods	National ratio, %	Territory, *1000 ha*	Animal breeding capacity*	Output, meat equivalent	Employee *persons*	Degree of self subsistence %
Only pasture	15	216	75 600	321,7	3 340	40
Pasture + mechanical maintenance, care	80	960	768 000	3268,1	27 650	60
Only mechanical cultivation (forage: hay)	5	96	144 000	612,8	1 890	85

Source:* standard animal/total territory (own data collection, 2007)

The organic performances of the Hortobágy Co. (see *table 2.*) are well known also on an international level. Their restaurant situated on the Hortobágy region (called "Hídi Csárda" – restaurant) gives the whole range of eco products in their menu, the foods and drinks, too. They also plan to supply the capital's restaurant: the Hotel Benczúr.
Some of the most important quality parameters of the Hungarian eco raw materials are shown in *Table 5.*, compared with some data originated from non organic production.
The organoleptic characteristics of the eco products are also very talkative. The sensory properties of almost every tested eco product were of higher quality than those of non eco products.

The human nutritional value of eco products is also superior. As an example their omega-3 fatty acid and CLA content can be shown, which are 15-20% higher in the extensively reared traditional cattle species.
The chemical composition of raw materials and products was analysed at the Hungarian Meat Research institute and at the University of Kaposvár, where also CT examination were performed using also standard methods.
For the protection of origin the Typi-Fix method was used (Agrobiogen Ltd., Germany).
The protection of origin is usually assured by the food safety and quality control processes. We believe that the protection of origin is highly important for the indigenous species that are traditional in our countries. Central European countries possess a large scale of indigenous animals; their special qualities can be confirmed with DNA analyses. With DNA marker analyses special qualities of some indigenous (as grey cattle, mangalitza pig and racka sheep) animals were proven.

Table 5. Comparison of chemical composition and some physical properties of Longissimus dorsi muscles of Holstein and grey cattle, and extensively and intensively reared mangalitza pigs

Characteristics	Grey cattle (extensively)	Holstein (intensively)	Mangalitza (extensively)	Mangalitza (intensively)
Protein content (%)	22,5	22,25	23,9	23,6
Fat content (%)	1,2	1,9	5,67	5,45
Connective tissue (%)	0,7	1,3	0,52	0,49
Pigment content (mg/g)	6,2	4,5	1,46	1,43
Fatty acid composition (%)				
SFA	43,8	45,8	38,9	43,4
MUFA	56,2	54,2	52,1	53,9
PUFA	20,8	13,4	8,11	5,39
n-3	5,1	1,3	0,5	0,14
n-6	14,4	11,3	7,35	4,98
n-6/n-3	2,9	9,3	17,2	35,57
pH	5,53	5,78	5,72	5,76
Colour characteristics				
Intensity	17,8	13,7	10,03	9,13
Hue	10,1	8,1	20,20	17,47
Dripping loss (%)	0,8	1,8	1,92	1,79
Cooking loss (%)	25,6	18,1	26,32	20,24
Hardness (N)	27,3	38,5	15,4	14,3

CONCLUSIONS

Summing up, we can state that the organic animal breeding and the products manufactured under organic conditions can promote the development of the whole animal breeding in a given region. Organic products can also contribute to the increase of healthy human nutrition. *Table 6.* shows some approach of the past and present conceptions about meats, with special regard to organic products.
The meat covers less than 20% of the calories from food, contains easily digestible proteins and high amounts of vitamins B_{1-12} and iron. For all these reasons the production

of traditional animals is beneficial. The increase of their production can contribute to the regional development, self subsistence and direct marketing, to the increase of the employee number in the agriculture and to the rural development. A more emphasized international collaboration in this field is also needed. We are ready to contribute to such of collaborations.

Table 6. Preconception and truth about meat

Preconception	Truth
The meat contains saturated fatty acids only.	The meat fat contains 55-65% unsaturated fatty acids.
Saturated fatty acids are unhealthy.	In heart attack LDL/HDL ratio is determinant
Consumption of fat meats increases the cholesterol level and loads the fat metabolism.	Saturated fatty acids from meat have slight cholesterol decreasing effect.
Meat consumption increases the risk of CVD.	The optimal n-6/n-3 ratio (2-3:1) decreases the risk of cardiovascular diseases (CVD).
Mediterranean nutrition with low meat content decreases the incidence of CVD.	At moderate meat consumption the vegetable consumption is high. The meat CLA content is anticarcinogenic.

REFERENCES

ARADI CS. (1992): Ökológiai szempontok megjelenése a táj- és természetvédelemben. A Kertészeti és Élelmiszeripari Egyetem Kiadványai A Lippay János tudományos ülésszak előadásai és posztere, Budapest, 11-15.

ÁNGYÁN J., PODMANICZKI L., ÓNODI G., SKUTAI J. (2002): A Nemzeti Agrárkörnyezetvédelmi Program. A Falu, Agroinform Kiadóház, Budapest. XVIII.2. 21-31. Kerekerdő: www.kerekerdo.org. 2009.12.22.

PONGRÁCZNÉ B. Á., MEZEI Z. (2008): Környezetkímélő agrotechnikák alkalmazása a búzatermesztésben. XIV. Nemzetközi környezetvédelmi és vidékfejlesztési diákkonferencia, Szolnoki Főiskola, Mezőtúr. 95.

PONGRÁCZNÉ B. Á. (2008): A minőségi őszi búza termesztés környezetkímélő agrotechnikai szintjei. Szolnoki Főiskola Műszaki és Mezőgazdasági Fakultás, Mezőtúr. VI. Alföldi Tudományos Tájgazdálkodási Napok. Mezőtúr, ISBN 978-963-87874-1-5, 364-368.

PONGRÁCZNÉ B. Á., PASZTERNÁK F., VÉHA A., GYŐRI Z. (2009): Környezettudatos agrotechnikák alkalmazása az őszi búzatermesztésben. II. Nemzetközi Gazdaságtudományi Konferencia, Kaposvár, ISBN 978-963-9821-07-1. 6pp.

PONGRÁCZNÉ B. Á., CSURGÓ Z. (2010): Az éghajlat hatása a Mezőtúr környéki rizstermesztésre. Agrár-és vidékfejlesztési szemle. Hódmezővásárhely, V.1.657-663, 2010.

VERESS L. (1987): International trends in sheep and goat breeding. 66. FAO Anim. Prod. and Health paper. Rome, 249 - 253.

VERESS L., ARADI CS., DUNKA B. (2000): A Hortobágy hasznosítása. Magyar Tudomány. Magyar Tudományos Akadémia Kiadója, Budapest.

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VEGETABLE GROWING ON EXPANDED CLAY

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ABSTRACT – Vegetable growing on expanded clay
As soilless gardening is becoming more popular, the broadening of knowledge on growing media with low environmental burden is continuously of interest. In the experiment we investigated the applicability of Liapor Hydro clay pebble products in greenhouse production of sweet pepper, tomato, eggplant and cucumber, using rockwool as the control medium (sweet pepper, tomato, eggplant) and peat-perlite mix (cucumber). The volume of substrate per plant was 5 liters in the case of pepper and tomato, 10 liters in the case of cucumber and 7.5 or 15 liters in the case of eggplant. Experimental results demonstrate the suitability of expanded clay as growing medium for the soilless greenhouse production of all four vegetables. In the case of eggplant, results relative to growing medium quantity, showing that the greater root volume produces greater yields, are an indication of the importance of making the choice of the volume in accordance with the growing medium.

Keywords: cucumber, eggplant, Liapor, sweet pepper, tomato

INTRODUCTION

An ever greater number of farms are compelled to change their production technology as a result of the monocultural production system characteristic in greenhouse vegetable growing, of the spread of soil-born pathogens and root-knot nematodes and of the unfavorable changes in the physical and chemical properties of soils (TERBE, PAP, 2008). The area of soilless production is ever greater in the whole world. Owing to the great number of new plant physiology knowledge applicable also in the practice of production, to the ever deeper knowledge of substrates and to technical inventions the annual growth of this production system can be estimated to be approximately 5% (VERDONCK, 2007).
Expanded clay has been used in horticultural production since 1936 (RAVIV ET AL., 2002), but the large-scale production in expanded clay pellets started in 1950 in Switzerland (FISCHER, MEINKEN, 1991).
Clay pellets are divided in several size ranges between 1 and 20 mm, but in the case of a few products also the 10-30 mm fraction is known (VERDONCK ET AL., 1980). According to shape, distinction is made between whole (round) balls and crushed clay pellets, but types containing a mixture of the two are also known (SLEZÁK, PAP, 2008), though generally the shapes close to sphere are in use (VERDONCK, 2007).
In the early 90s IMRE carried out a series of experiments with pepper on the substrates of production systems isolated from the soil. Based on the results of the experiments he concluded that expanded clay was suitable for cultivation if accompanied with the elaboration of a suitable fertigation system (IMRE, 1993, 1994). Italian researchers gathered favorable experiences with the use of the product in the size range of 2-4 mm in greenhouse tomato production in expanded clay pebbles (CALABRETTA ET AL., 1994). In greenhouse cucumber cultivation, in the two-year experiment of BÖHME (1995) expanded clay pellets produced higher yields compared to rockwool, while used in the second year produced ones significantly lower.

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At the Department of Vegetable and Mushroom Growing of Corvinus University of Budapest the research of substrates has great traditions. The present publication is a summary of some of technology development researches on production in expanded clay pellets (Liapor Hydro 4/8, Liapor Hydro 4/8 KK) and a synthesis of the results.

MATERIAL AND METHOD

We studied the applicability of Liapor Hydro clay pebble products in hydroponic production of **sweet pepper**, using rockwool for control medium. In the treatments containing the clay pellets, the white plastic bags serving for covering the rockwool slabs were filled with 15 liters of clay pellets. In plant nutrition, we used the formula and nutrient solution concentration recommended for rockwool pepper production. Irrigation frequency and length were set to accord with plant development. The fruits were divided into the following quality categories: extra ((>100 g), 1st class (80-100 g), 2nd class (60-80 g), 3rd class (40-60 g), substandard and tiny fruits (including the strongly deformed or blotched ones, mainly with Ca deficiency, and the ones under 40 grams).

In greenhouse **tomato** production we also used the plastic bag cultivation, with rockwool control. In irrigation and fertigation, for all three treatments we used the formula and nutrient solution concentration recommended for rockwool tomato cultivation, with as many as 15-20 irrigations per day. As the nutrient solution amount optimal for rockwool grown plants proved to be insufficient for the plants planted in expanded clay pellets, two additional drippers were pricked into each bag filled with the clay pellets, into the part between the rockwool cubes. At the pickings the number and total weight of the fruits collected from the 12 plants were registered.

In the case of **eggplant**, using the same plant spacing, the plastic bags with a filling length of 1 meter were planted with one or two plants because of the 66 cm spacing (2 plastic bags were planted with 3 plants). As a result, in the analyses, separate investigations could be carried out on the effect of 7.5 and 15 liters root volume per plant. In the experiment the two different 4/8 size expanded clay pellets were compared with rockwool in an irrigation-fertigation system for rockwool grown plants. Each plant was considered to be a separate plot. As yield results of the plants were different with the two planting types, their results were compared separately and also the effect of the growing media volume was studied.

Experiment on greenhouse **cucumber** production was set up in Mórahalom (South Hungary) in a plastic tunnel of Filclair type. Prior to planting, 10-10 buckets were filled with expanded clay pellets in the plastic tunnel, and further 10 buckets filled with peat containing soil mix were assigned to be control plots. Irrigation and fertigation were carried out in accordance with the requirements of the plants planted in peat containing soil mix (2-10 times a day). Two pickings per week were carried out and at the pickings, divided into classes we measured the number and total weight of the fruits collected from the 10 plants on each plot.
Detailed technological parameters of the experiments are reported in *Table 1.*

Table 1: Technological data of trials

Species			Sweet pepper	Tomato	Eggplant	Cucumber
Location of trials			Budapest, Corvinus Univ.	Szentes	Budapest, Corvinus Univ.	Mórahalom
Variety			Hó	Annet	Madonna	Ceres
Site of trials			plastic greenhouse of Filclair type	10 m long plastic tunnel	plastic greenhouse of Filclair type	plastic greenhouse of Filclair type
Method of cultivation			plastic bag	plastic bag	plastic bag	container
Expanded clay product tested			H4/8KK	H4/8, H4/8KK,	H4/8, H4/8KK,	H4/8, H4/8KK
Control substrate			rockwool	rockwool	rockwool	90% peat + 10% perlite
Seedling growing medium			rockwool	rockwool	rockwool	peat
Date of planting			March 30th	Feb 28th	May 9th	Feb 23rd
Plant density			4 plants/m^2	3.8 plants/m^2	2 plants/m^2	1.95 plants/m^2
Pickings	date	first	May 17th	Apr 26th	June 17th	Apr 5th
		last	Oct18th	June 12th	Oct 16th	July 27th
	number (total/early)		15 / 1-5.	7 / 1-3.	18 / 1-5.	33 / 1-11.

RESULTS

Sweet pepper

The higher total yields were characteristic to the plots with expanded clay pellets (*Table 2*), though no statistical difference was detectable between the two media and almost all over the growing season the best result was produced by the rockwool. The proportion of substandard fruits was very low in all of the treatments.

Table 2: Sweet pepper yields with plastic bag cultivation

Treatment	Yield weight [kg/m^2]				Fruit number [fruits/m^2]			
	Total	Early	Extra + 1st class	Subst.*	Total	Early	Extra + 1st class	Subst.*
H4/8KK	18.36	3.85	9.66	0.28	231.20	53.67	90.53	4.13
Rockwool	17.76	4.05	9.97	0.64	216.01	51.94	93.84	8.58

*Substandard

Tomato

The yields of the plants grown in rockwool were approximately 0.76 kg higher per m^2 than those of the plants grown in expanded clay (*Table 3*). Of the two different expanded clay pellet types the H4/8KK produced somewhat better results than the H4/8. In the case of the former the fruiting graph had almost the same pattern as that of the plants grown in rockwool.

Table 3: Tomato yields [kg/m^2]

Treatment	Total	Early
H4/8	26.82	8.52
H4/8KK	27.04	11.65
Rockwool	28.09	12.41

Eggplant

Considering total yields it can be seen (*Table 4*) that in the case of planting one plant per slab the rockwool was the most favorable but the treatment H4/8 was only slightly inferior. The H4/8KK on the other hand produced yields that were almost 30% inferior (5.18 kg) to that produced by the rockwool. When two plants were planted on the same slab, the difference between the three treatments was less than 0.30 kg. In the case of the rockwool and the expanded clay H4/8 the greater root volume per plant was significantly superior to the smaller one.

Table 4: Eggplant yields

Treatment	Total	Early	Marketable	Substandard
Yield weight [kg/m^2]				
1 plant / plastic bag				
H4/8	17.70^{aA}	3.56^{abA}	13.85^{abA}	3.85^{aA}
H4/8KK	12.61^{bA}	2.45^{bA}	10.48^{bA}	2.13^{aB}
Rockwool	17.96^{aA}	5.26^{aA}	15.35^{aA}	2.61^{aA}
2 plants / plastic bag				
H4/8	13.70^{aB}	4.59^{aA}	9.97^{aB}	3.73^{aA}
H4/8KK	13.76^{aA}	2.71^{aA}	9.97^{aA}	3.79^{aA}
Rockwool	13.68^{aB}	3.85^{aA}	10.80^{aB}	2.88^{aA}
Two factor variance analysis results				
Planting method	$p<0.05$	-	$p<0.05$	-
Growing medium	$p<0.05$	$p<0.05$	$p<0.05$	-
Planting method x growing medium	$p<0.05$	-	-	-
Fruit number [fruits/m^2]				
1 plant / plastic bag				
H4/8	62.00^{aA}	20.00^{abA}	40.00^{abA}	22.00^{aA}
H4/8KK	39.00^{bA}	12.00^{bA}	29.00^{bA}	10.00^{bB}
Rockwool	54.00^{aA}	22.00^{aA}	42.00^{aA}	12.00^{abA}
2 plants / plastic bag				
H4/8	48.80^{aB}	20.00^{aA}	29.80^{aA}	19.00^{aA}
H4/8KK	49.50^{aA}	16.50^{aA}	29.30^{aA}	20.20^{aA}
Rockwool	50.00^{aA}	19.50^{aA}	34.50^{aB}	15.50^{aA}
Two factor variance analysis results				
Planting method	-	-	-	-
Growing medium	$p<0.05$	$p<0.05$	-	$p<0.05$
Planting method x growing medium	$p<0.05$	-	-	-

Note: The different small letters next to the numbers in the columns indicate the statistical difference at $p<0.05$ level of the effect of the media, and the capitals that of the planting method (root volume)

In terms of total fruit number the two planting methods showed difference again. In the investigation of the plants grown singularly the best result was produced by the expanded clay H4/8, while in the case of planting in pairs the rockwool. In the case of the former the H4/8KK treatment produced an almost 40% lower result than the H4/8, while a result between the two was reached in the rockwool. In the second case the lowest number of fruits were harvested from the plants of the treatment H4/8, but it was only 13% inferior to the rockwool. Comparing the two planting methods, significant difference occurred only in the case of the medium H4/8, for the advantage of the greater root volume.
The level of the Ca-deficient, damp and soft (substandard) fruits was relatively high in each treatment, but the planting of two plants per bag (i.e. the lower root volume per plant) resulted in a higher proportion of substandard fruits.

Cucumber

The highest numbers of fruits were produced by the plants planted in the peat containing mix, though the yield weight of the plants grown in the expanded clay pellets was only 15-20% lower and their fruit number only 10-12% lower (*Table 5*). In terms of the total yields no significant difference was found between the two different expanded clay types. Considering the qualitative distribution of fruits it can be seen that the proportion of the 1st class fruits (over 90%) was very favorable in each treatment.

Table 5: Cucumber yields

Treatment	Yield weight [kg/m^2]			Fruit number [fruits/m^2]		
	Total	Early	1st class	Total	Early	1st class
H4/8	18.40	7.16	17.25	49.45	19.18	44.93
H4/8KK	17.59	7.32	16.19	47.95	19.59	42.88
Peat + Perlite	21.58	8.81	20.36	54.66	23.15	50.14

CONCLUSIONS

Experimental results show the suitability of expanded clay pellets for root medium in the soilless greenhouse production of sweet pepper, tomato, eggplant and cucumber. With the refinement of the irrigation-fertigation system probably the yields of each species can be increased. In the case of the eggplant the results on the amount of the growing medium, according to which the greater root volume increases yields, show that choosing the volume in accordance with the substrate can also have great significance.

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REFERENCES

BÖHME, M. (1995): Evaluation of organic, synthetic and mineral substrates for hydroponically grown cucumber. Acta Horticulturae 401: International Symposium on Growing Media & Plant Nutrition in Horticulture. Naaldwijk, Netherlands. p. 209-218.

CALABRETTA, C., NUCIFORA, M.T., FERRO, B., DI NATALE, V. (1994): New techniques for the cultivation and defence of tomato crops in cold greenhouse in the area of Ragusa (Sicily). Acta Horticulturae 361: International Symposium on New Cultivation Systems in Greenhouse. Cagliari, Italy. p. 530-544.

FISCHER, P., MEINKEN, E. (1991): Blähtone für die Hydrokultur. Deutscher Gartenbau. 27: 1678-1679.

IMRE, CS. (1993): Paprika hidrokultúrás termesztése zeolitban és égetett agyaggranulátumban. Kertgazdaság. 25(5-6): 1-7.

IMRE, CS. (1994): Gyökérrögzítő közegek hatása a paprika (*Capsicum annuum* L.) növekedésére, terméshozamára és a bogyók minőségi jellemzőire. Candidate's thesis. Kertészeti és Élelmiszeripari Egyetem, Budapest. Manuscript. 132 p.

RAVIV, M., WALLACH, R., SILBER, A., BAR-TAL, A. (2002): Substrates and their analysis. In: SAVVAS, D., PASSAM, H. (ed.) Hydroponic Production of Vegetables and Ornamentals. Embryo Publications, Athens. p. 25-102.

SLEZÁK K., PAP Z. (2008): A talaj nélküli termesztésben használatos közegek jellemzése. In: Terbe I. Slezák K. (ed.): Talaj nélküli zöldséghajtatás. Mezőgazda Kiadó, Budapest. p. 89-105.

TERBE I., PAP Z. (2008): Bevezetés. In: Terbe I. Slezák K. (ed.): Talaj nélküli zöldséghajtatás. Mezőgazda Kiadó, Budapest. p. 9-19.

VERDONCK, O. (2007): Status of soilless in Europe. Acta Horticulturae 742: International Conference and Exhibition on Soilless Culture: ICESC 2005. Singapore, Singapore. p. 35-39.

VERDONCK, O., DE VLEESCHAUWER, D., DE BOODT, M. (1980): Growing ornamental plants in inert substrates. Acta Horticulturae 99: Symposium on Substrates in Horticulture other than Soils In Situ. Auchincruive, Scotland. p. 113-118.

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HABITAT SELECTION OF THE EURASIAN BADGER IN VARIOUS AREAS OF HUNGARY

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ABSTRACT – Habitat Selection of the Eurasian Badger in Various Areas of Hungary
We examined the habitat use patterns of the Eurasian badger in one area among mountains, one among hills and one on the Great Plain of Hungary. These examinations were based on burrow estimation by striped transect, and they were carried out by categorising the habitat types in which badger burrows were detected.
We found that badgers prefer forested areas, predominantly pine-forests and mixed pine-forests, for digging their burrows. They seem to avoid areas of open fields, although occasionally they do dig burrows in such areas, especially if the percentage of forest cover is low.

Keywords: Eurasian badger, habitat selection, den

INTRODUCTION

The distribution of the Eurasian badger extends from Ireland to Japan, spreads from Finland throughout Israel across Iran and Afghanistan even to China. It is only lacking from the Balearic Island in Europe. The occurrence ranges between 1600 and 1700 above mean sea level. The European badger may find its life conditions in deciduous and mixed forests but shrubby and agricultural areas, as well (MITCHELL-JONES ET AL., 1999). WOZENCRAFt (2005) in his last-edited summary particularly emphasizes the recently experienced significant increase of population size in the British Islands and Ukraine. According to HOLMALA AND KAUHALA (2006) the population of badger is growing in whole Europe. The oral rabies vaccination program might stay in its background.
The European badger in Hungary was protected between 1973 and 2001, since than became game species and hunted from 1st of June till 28th of February. However its population was still continuously growing and spreading. The area-occupation of European badger in Hungary can practically be considered to be finished and nowadays there is not any Hungarian landscape without the occurrence of this species (LANSZKI AND HELTAI 2010). The reason of the wideness of the European and Hungarian dispersal area, and increase in populations in several European countries and so in Hungary is the adaptability and flexibility of this species both to habitat and feeding conditions. During its habitat selection the aspects of equally the suitable sites for digging setts that are not threatened by falling down (NEAL AND CHEESEMAN 1996), and the proper sheltering (CRESSWELL ET AL., 1990) are important for the Eurasian badger. HELTAI AND KOZÁK (2004), and KOZÁK AND HELTAI (2006) studied the species' selection of den sites, principally considering the aspects of vegetation and cover, during their badger-habitat-preference studies on the Hungarian Plain (Erdőspuszta next to Debrecen, and Hortobágy). Their data showed small preference of forested areas within the two sample sites where environmental factors (such as geological, hydrological, feeding source patterns) enable. At Erdőspuszta preference of the Pinus sylvestris plantations is showed. They suggest that the very low preference of

opened areas on the Hortobágy sample site may be caused by geological and hydrological parameters. Based on the data of their samples the habitat-preference of European badger on plain only partly depends on the vegetation and cover. The geological and hydrological parameters, by chance the nutrient-supply situation are often more dominant. Beside this study that was done in Hajdú-Bihar country there are not any other data available from Hungary about the habitat use of this species. Hence our aim was to study the habitat use at the choosing burrows' location in case of the Eurasian badger in three different landscapes: in the Bakony that is considered to be mountainous area in the Hungarian context, in the Gödöllő Hills, and at a recently occupied habitat that is called Kiskunság. We investigated the preferred and avoided habitat type of the three different landscapes and we were searching for the habitat parameters that were decisive to the presence of the species.

MATERIALS AND METHODS

Study areas

Bakony

The Bakony study area was a fenced, 3768.46 ha game preserve that is bordered by eight settlements (Veszprém, Márkó, Bánd, Szentgál, Nemesvámos, Tótvázsony, Nagyvázsony és Úrkút). The terrain within this area is mainly unstructured. The average valley density is between 2.5 – 2.6 km/km^2, the average above mean sea level is 320 metres. The soil consists of low productive leptosols on limestone and dolomite bedrock. Forests of this area are supplemented with diverse size clearings, meadows, agricultural areas, and watercourses. Almost the entire game preserve – from Nagyvázsony to Bánd – is continuously forested. The together 400 ha ploughland is utilized as game field; alfalfa, triticale, wheat, sunchoke (Helianthus tuberosus), and partly grass is produced on this areas.

Gödöllő Hills

The observations were done between Isaszeg and Pécel. The former bedrock of the Gödöllő Hills was loess that was covered by a thinner-thicker diluvial sand sediment layer. Beside the typical loess that covers large areas loessy sand and sandy loess are frequently found, as well. This landscape ranges between 130-344 a.m.s.l. The scale of soil-erosion is remarkable; the typical site condition is dry. Water reservoirs, fishponds can be found both within and out of the forests between Isaszeg and Pécel. The size of the observed area included into the burrow-estimation was 1430 ha.

Kiskunság

We conducted the investigation on the borderline of Pest and Bács-Kiskun countries between Kunpeszér and Kunszentmiklós all together on 4060 ha. This area can be spited into two parts. The first is a solonchack barren, saline meadow and pasture called Nagyrét (protected area) that is located at the lower elevations of the Danube's former floodplain. The groundwater level may be high in the early spring here, but till the beginning of the summer, due to the evaporation and the suction effect of the sewage system, that was implemented in the beginning of the XXth century to solve the groundwater problems, dries up and the saline marshes are only to find separately in small patches.

The soil of the Kiskunság-study area is mainly bad water balanced heavy soil, additionally with a few sandy back. The other part of the investigation area is surrounding the eastern part of the Nagyrét. It consists of mainly non protected agricultural areas that are complemented by small forest patches and settlement mosaics. Here we almost exclusively

find only sandy soils. Between 95 and 102 a.m.s.l. without any steep or unexpected changes, that means evenly plain site.

Burrow estimation

Burrows were estimated by parallel, North-South oriented stripped transects at all the three areas. The decision whether the found den is inhabited or not and whether the inhabiting species is Eurasian badger or red fox, was based on the surrounding indirect indices (footprint, latrine). The widths of the respective track-sections were continuously recorded. During the implementation, data recording, and evaluation of our field work we used the methods given by HELTAI AND KOZÁK (2004), and KOZÁK AND HELTAI (2006).

Calculation of habitat preference

After determining the exact locations of badger-burrows that were found in the three different study landscapes the scales of preferences were counted according to the Ivlev's formula (Ivlev 1961): Px=(A-B)/(A+B) where A is the rate of burrows in the respective habitat type compared to the total number of burrows within the respective landscape; B is the rate of the area of respective habitat type to the total area of the respective landscape; Px is a value of preference/avoidance of the respective habitat type (range [-1;1]). (+1) means total preference whereas (-1) suggests overall avoidance. The significance of the preference values were calculated using Chi^2-test, and Bonferroni Z-test after the necessary merges of the habitat-type categories. The same tests were used to compare the landscapes and to determine the most important habitat categories that are decisive at the habitat use of the European badger.

RESULTS

The results of habitat use based on the spatial distribution of the burrows show overall preference of coniferous forests (Ivlev-index values per landscapes: Gödöllő Hills: 0.62; Bakony: 0.43; Kiskunság: 0.91) and general avoidance of opened sites such as meadows, pastures, ploughlands, however entire avoidance only were found in the Gödöllő Hills (Ivlev-index values per landscapes: Gödöllő Hills: -1.00; Bakony: -0.30; Kiskunság: -0.63) (*figure 1.*).

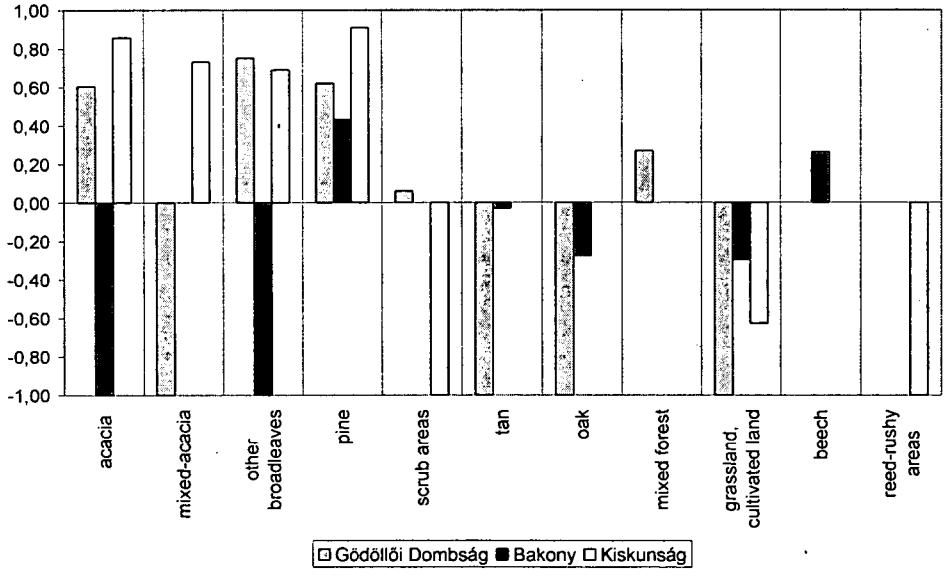

Figure 1. Habitat preference values on the study area, estimated by European badger-burrows (Y-axis: Ivlev-index). Missing values mean absence of the respective habitat type at the certain landscape.

Using Bonferroni Z-test the preference of Robinia pseudoacacia and coniferous forests were proven to be significant in the Gödöllő Hills, just like the avoidance of opened sites (Bonferroni Z (4) = 2.500; $p<0.05$). The other preferences and avoidances were not significant. In the Bakony neither of preference values were significant (Bonferroni Z (3) = 2.407) but in the Kiskunság landscape preference of deciduous forests and avoidance of opened sites were significant (Bonferroni Z (3) = 2.407; $p<0.05$). However it is important to underline, that the above mentioned habitat categories had to be merged into larger groups during the significance-analyses, because otherwise the area of certain habitat types often were not large enough compared to the total area size, which unable us to use the Chi^2-test.

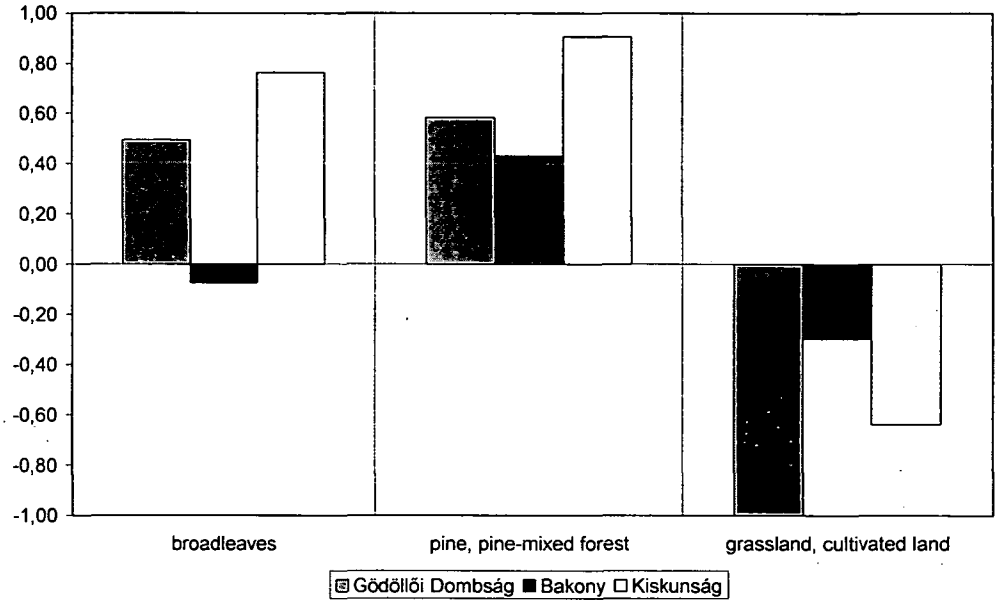

Figure 2. Comparison of the merged habitat uses of the three studied landscapes (Y-axis: Ivlev-index)

To be able to compare the landscapes habitat categories first had to be merged. It had two main reasons: the above mentioned statistical criteria and the fact, that these landscapes are different, and some habitat types are not to find at either landscapes. This comparison confirms the results of the previous observations about the avoidance of opened sites and preference of coniferous forests. All of the preferences and avoidances of the three habitat types in the Gödöllő Hills were significant ($p<0.05$). In the Bakony were neither of the values significant, hence in the Kiskunság preference of deciduous forests and avoidance of opened sites are considered to be significant (Bonferroni Z (3) = 2.407; $p<0.05$) (*figure 2.*).

CONCLUSIONS-DISCUSSION

Our results prove our hypothesis that the European badger can widely adapt to the habitat conditions. However, taking in account the feeding habits and habitat use of this species, mainly based on research studies in the United Kingdom (NEAL AND CHEESEMAN, 1996; LANSZKI AND HELTAI 2010), the stronger preference of coniferous or partly coniferous forests than the preference of deciduous forests is surprising. Its reason is probably the fact

that the coniferous plantations on the Hungarian Plain were mainly implemented on extensive, low productivity sand-soils that are suitable for digging burrows. The avoidance of the opened sites was also an expected result. However, the plasticity of the European badger is shown well by the fact, that in case of necessity it burrows on opened sites as well, especially at low forestation (e.g. Kiskunság).

CITED LITERATURE

CRESSWELL, P., HARRIS, S., JEFFERIES, D.J. (1990): The history, distribution, status and habitat requirements of the badger in Britain. Nature Conservancy Council, Peterborough, pp. 1-42.

HELTAI, M., KOZÁK, L. (2004): A borz kotoréksűrűségének felmérése két alföldi területen. Vadbiológia, 11: 83-91.

HOLMALA, K., KAUHALA, K. (2006): Ecology of wildlife rabies in Europe. Mammal Review, 36: 17–36.

IVLEV, V.S. (1961): Experimental ecology of the feeding of fishes. Yale University Press, New Haven Conn.

KOZÁK, L AND HELTAI, M. (2006): A borz (Meles meles Linnaeus, 1758) élőhely-preferenciája Hajdú-Bihar megyében. Állattani Közlemények, 91(1): 43-55.

LANSZKI JÓZSEF AND HELTAI MIKLÓS (2010): Eurázsiai borz (Meles meles Linnaeus, 1758). 67-72 pp. In.: Heltai, M. (eds.) (2010): Emlős ragadozók Magyarországon. Mezőgazda Kiadó, Budapest. 240 pp.

MITCHELL-JONES, A.J., AMORI, G., BOGDANOWICZ, W., KRYSTUFEK, B., REIJNDERS, P.J.H., SPITZENBERGER, F., STUBBE, M., THISSEN, J.B.M., VOHRALIK, V., ZIMA, J. (Eds.) (1999): The Atlas of European Mammals. Academic Press, London.

NEAL, E., CHEESEMAN, C. (1996): Badgers. T and AD Poyser Ltd. London.

WOZENCRAFT, W.C. (2005): Order Carnivora. In: Mammal Species of the World. (Eds.: Wilson, D.E., Reeder, D.M.) The Johns Hopkins University Press, Baltimore, pp. 532-628.

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EFFECT OF DIFFERENT PROTEIN LEVELS ON, TESTICULAR PARAMETERS AND SEMEN QUALITY IN KIVIRCIK RAM LAMBS DURING PUBERTAL DEVELOPMENT

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ABSTRACT – Effect of Different Protein Levels on, Testicular Parameters and Semen Quality in Kivircik Ram Lambs During Pubertal Development
The aim of this study was to determine the effects of different protein levels on, testicular parameters and semen quality in Kivircik ram lambs during pubertal development. Two experimental groups were formed. Following weaning, crude protein (CP) were 12% CP in group I (low protein diet) and 18% CP in group II (high protein diet). Measurements of live weight and testicular characteristics were performed in 20 days intervals starting from 115 days up to 195 days of age. There was an increase in semen volume, spermatozoa concentration and the percentage of progressively motile sperm in both groups between 135 and 195 days of age. Group I had significantly higher semen volume on day 175 ($P<0.05$). Furthermore, spermatozoa concentration were higher in group I than those in group II on days 155 and 175 ($P<0.05$). Values of live weight, testicular diameter, testicular circumference, testicular length and testicular volume of ram lambs in group II (high protein diet) were higher than those in group I (low protein diet). Testicular length and testicular volume of group II were significantly higher than those of group I on day 195 ($P<0.05$). Live weight and testicular characteristics of ram lambs fed with high protein diet were affected positively during pubertal development. However, it was observed that feeding with high protein diet had negative effect on semen characteristics by impaired thermoregulation mechanism and spermatogenesis in testicles because of excessive fat accumulation in scrotum.

Keywords: ram lambs, reproduction traits, feed, protein levels.

INTRODUCTION

Nutrition plays a major role in many aspects of male reproduction, including attainment of sexual maturity, both in terms of spermatogenesis and libido (CARPENTER et al., 1997). The study of the reproductive function in different ruminant species has provided evidence for the effects of nutrition during the growing period on the development of the hypothalamic-pituitary gonadal axis and hence on the onset of puberty. It has been reported that low planes of nutrition during the prepuberal period in ruminants delay testicular growth and the onset of puberty by inhibiting the development of a mature reproductive endocrine system (PRUITT AND CORAH, 1985).

There is now considerable evidence suggesting that the influence of nutrition on reproductive processes is mediated via effects of dietary constituents on the hypothalamic-pituitary axis, although there is some indication that dietary changes may affect the testis directly (BROWN, 1994). Undernutrition negatively influences attainment of puberty (FOSTER et al., 1998). However, the mechanism by which nutrition influences reproduction

is largely unknown. Nevertheless, it is noteworthy that there is some controversy about the effects of additional nutritive supply, above maintenance requirements, during the pre-pubertal period on testicular development and semen characteristics.

Thus, it has been reported that the reproductive potential of young males may also be impaired by overfeeding. COULTER AND KOZUB (1984), observed a detrimental effect of high energy intake on 2-year-old Hereford bulls, as measured by epididymal sperm reserves and sperm motility and morphology.
MORROW et al. (1981) evaluated the effects of low and high energy diets on the growth and reproductive development of Angus and Simmental bulls and found that the low energy group showed higher values of fertility and libido.
In contrast to the above-mentioned results, several studies did not reveal any effect of the level of nutrient intake during the pre and postpubertal period of young bulls and rams on reproductive traits, such as testicular size, semen quality or serving capacity, attainment of puberty (BIELLI et al., 2001). It was reported that reproductive characteristics of ram lambs were effected by different feeding in early stage of their life, and these differences were compensated by improving of feeding (SUTAMA and EDEY, 1986).

This study was carried out in order to determine the effects of feeding the Kivircik ram lambs during the pubertal period with two diets that have same energy levels but different protein levels on growth performance, testicle morphology and semen quality.

MATERIAL AND METHODS

This research was conducted in the boxes of Education and Research Hospital in Veterinary Faculty, University of Istanbul.
Twenty single-born ram lambs were used for the research. Kıvırcık ram lambs were housed together with the other lambs starting from lambing until weaning. The lambs were weaned at three months age.
During the suckling period, lambs were fed with lucerne and concentrate feed. Following weaning, lambs were transported to experimental pens. Ram lambs were randomly assigned into two groups (n=10).
The experimental groups were designed according to the percentage of crude protein and source of protein of the diet. In addition, the energy levels of the diets in both groups were kept equal. Crude protein (CP) and metabolic energy (ME) levels were 12% CP, 2.54 Mcal/kg in group I (low protein diet) and 18% CP, 2.52 Mcal/kg in group II (high protein diet) (tab. 1).
For fiber intake, only high quality lucerne was fed. At the beginning of the trial, lambs were fed with 600 g/head/day concentrate feed and 200 g/head/day lucerne on average. During the experiment, amounts of concentrate feed and lucerne were increased up to 1000 g/head/day and 400 g/head/day.
Drinking water was available continuously during the experiment period. Data has been collected for the first time when the ram lambs were 115 days old.
Measurements of live weight and testicular characteristics (testicular diameter, testicular length, scrotal circumference and testis volume) were taken every 20 days until the end of the experiment.
Sperm was evaluated for each 20 days interval starting from 135 until 195 days of age.

Table 1. Formulation and chemical composition of the experimental diets

Ingredients	Group I (Low protein diet)	Group II (High protein diet)
Lucerne	15	15
Wheat bran	10	13
Barley grain	69.5	47.5
Soybean meal	2	21
Salt	1	1
Sodium bicarbonate	0.5	0.5
Limestone	1.5	1.5
Vitamins and mineral mix*	0.5	0.5
Total	100	100
Calculated chemical composition (% DM basis)		
Dry matter (%)	90.09	90.06
Crude protein (%)	12	18
ME (Mcal/kg)	2.54	2.52

Live weight was recorded in the morning before feeding. Testicular diameter was recorded with a caliper on the left and right testicles as the widest anteroposterior diameter. Testicular length was also measured with a caliper both on the left and right testicles as the distance between the top of the tail and the head of the epididymis. Scrotal circumference was measured with a flexible tape at the point of maximum circumference of paired testes. Paired testicular volume were calculated by 0.0396 x (average testis length) x (scrotal circumference)^2 (GODFREY, 1998). Semen was collected from rams using a manually controlled electro-ejaculator (P-T Electronics, Model 304, USA) with a rectal probe that has three electrodes. The rectal probe was lubricated and gently inserted into rectum, and orientated so that the electrodes were positioned ventrally. Electric current was applied starting from 1 volt for 2 sec with 2-sec rest intervals between stimuli, increasing the voltage stimuli by one volt at a time. The penis was prolapsed beyond the prepuce, and semen was collected into a graduated collection vial attached to an artificial vagina at room temperature. Collected semen were immediately transported to the laboratory and immersed in a water bath at 30°C. Volume of ejaculates was read directly from a graduated collection container with 0.1 ml intervals. The spermatozoa concentration was determined by optical density with a spectrophotometer (Photometer SDM4, Minitüb, Germany) calibrated for ram species (1:1000 dilution rate). A small subsample of semen was diluted with physiological saline on a slide, covered with a cover slip and placed on a microscope stage at 37°C. The percentage of progressively motile sperm was estimated qualitatively by examining approximately eight fields at a magnification of 400x (MARCO-JIME'NEZ, 2005). To avoid variance, all semen measurements were analyzed by a single researcher in this study.

In the statistical analysis, all the related characteristics were investigated (live weight, testicular characteristics, testosterone concentrations and semen characteristics). Independent Samples t-test was used to observe whether any differences existed between groups (ZAR, 1996). Calculations have been made using the SPSS program pack (OZDAMAR, 1999).

RESULTS

The effects of nutrition on live weight, testicular characteristics and semen quality during the pubertal development period of the ram lambs have been investigated in this study. The results for the semen characteristics are presented in Table 2. There were increases in semen quality values in both groups between 135 and 195 days of age. Although increases in these values were generally higher in group I (low protein diet), there were statistical differences ($P < 0.05$) for semen volume on day only 175, and for spermatozoa concentration on days 155 and 175. No statistical difference was observed between the groups in terms of motile spermatozoa during the study. The measurements on the 195th day of the study coincided with the quality season. No difference between the groups in terms of semen quality was observed for this period.

Table 2. Mean (± S.E) of semen characteristics (semen volume, spermatozoa concentration and motile spermatozoa) in ram lambs from 135 to 195 days

Days	Groups	n	Semen volume (ml)	Spermatozoa concentration (..x 10^9/ml)	Motile spermatozoa (%)
135	I	5	0.48 ± 0.10	0.56 ± 0.26	23.0 ± 15.3
	II	6	0.48 ± 0.12	0.27 ± 0.14	14.2 ± 12.3
155	I	10	0.99 ± 0.07	0.97 ± 0.10^a	63.5 ± 2.9
	II	10	0.75 ± 0.08	0.51 ± 0.11^b	60.5 ± 4.6
175	I	9	1.12 ± 0.13^a	1.00 ± 0.14^a	70.0 ± 4.1
	II	10	0.88 ± 0.15^b	0.58 ± 0.14^b	65.0 ± 6.4
195	I	10	1.14 ± 0.11	1.42 ± 0.21	72.0 ± 3.1
	II	10	0.92 ± 0.06	1.40 ± 0.25	69.0 ± 4.2

$^{a, b}$ Means within a row with different superscripts are significantly different ($P < 0.05$).

The developments of live weight and testicular characteristics are presented in Table 3. Values for live weight, testicular diameter, testicular circumference, testicular length and testicular volume of rams in group I were lower compared to those in group II for all observations (on days 115, 135, 155, 175 and 195). An increase was observed in all parameters from day 115 to day 195 in both groups. While statistically no significant difference was found between two groups on days 115, 135, 155 and 175 in all parameters, there was a statistical difference on day 195 for testicular length and volume between the two groups ($P < 0.05$). The live weight and testicular parameters of the ram lambs in group II (high protein diet) were higher than the ram lambs in group I (low protein diet) for all the time intervals included in the study (at days 115, 135, 155, 175 and 195). While no statistical difference has been observed between the groups in terms of the above mentioned parameters, but only the differences at testicular length and testes volume on the 195th day between the two groups were statistically different ($P<0.05$).

Table 3. Mean (± S.E) value of live weight and testicular characteristics at different times throughout the experiment for ram lambs

Days	Groups	n	Live weight (kg)	Scrotal circumference (cm)	Testicular diameter (cm)	Testicular length (cm)	Testes volume (cm^3)
115	I	10	27.3 ± 1.2	18.6 ± 0.9	2.98 ± 0.2	6.28 ± 0.5	93 ± 17
	II	10	27.8 ± 0.9	18.7 ± 0.9	2.93 ± 0.2	6.76 ± 0.4	100 ± 16
135	I	10	28.9 ± 1.1	21.1 ± 1.3	3.69 ± 0.3	7.95 ± 0.4	152 ± 23
	II	10	30.6 ± 1.2	21.8 ± 1.2	3.79 ± 0.2	8.13 ± 0.4	164 ± 25
155	I	10	31.4 ± 1.3	24.8 ± 1.3	4.37 ± 0.3	9.12 ± 0.4	233 ± 27
	II	10	35.2 ± 1.7	27.7 ± 0.9	4.77 ± 0.2	9.90 ± 0.4	310 ± 34
175	I	10	36.1 ± 1.5	26.8 ± 1.3	4.56 ± 0.3	9.47 ± 0.4	282 ± 33
	II	10	39.8 ± 1.4	28.9 ± 0.9	5.10 ± 0.2	10.4 ± 0.4	354 ± 33
195	I	10	39.3 ± 1.5	28.3 ± 0.8	5.06 ± 0.2	10.7 ± 0.4 [b]	344 ± 27 [b]
	II	10	42.8 ± 1.2	30.5 ± 0.9	5.24 ± 0.2	11.7 ± 0.3 [a]	437 ± 30 [a]

[a, b] Means within a row with different superscripts are significantly different ($P < 0.05$).

Similarly, higher motility, density and semen volume value have been obtained from group I (low protein diet) compared to group II (high protein diet) during the entire research period. It is assumed that the results that have been obtained are a because of the fact that a high protein diet results in the excess fat to be stored in the scrotum, thus the thermoregulation mechanism in the testis and the spermatogenesis to collapse.

CONCLUSIONS

The results show that diets with equal energy levels but different protein levels have different effects on the live weight, testicular parameters and sperm parameters of the Kivircik ram lambs. It has been determined that the live weight and testicular parameters of the ram lambs that were fed with high protein diets during the pubertal period have been affected positively.

In conclusion, feeding with high protein diet had negative effect on semen characteristics by collapsed thermoregulation mechanism and spermatogenesis in testicles because of excessive fat accumulation in scrotum. A research on the effects of diets with different energy and protein levels on the testicular and spermatogenesis parameters of the ram lambs will be beneficial and contribute to the existing literature.

REFERENCES

BIELLI A., KATZ G,M PEDRANA G., GASTEL M.T., MORANA A., CASTRILLEJO A., NILS L., MATS F., HERIBERTO R.M. (2001): "Nutritional management during fetal and postnatal life and the influence on testicular stereology and sertoli cell number in Corriedale ram lambs". Small Rumin. Res. 40, p. 63-71.

BROWN B.W. (1994): "A review of nutritional influences on reproduction in boars, bulls and rams". Reprod. Nutr. Dev., 34, p. 89-114

CAPRENTER D.B., HALLFORD D.M., SI-SHANG HUNG, HAWKINS D.E. (1997): "Semen traits and metabolic and gonadotropic hormone profiles in ram lambs treated with glucose". Theriogenology, 48, p. 625-639.

COULTER G. H. AND KOZUB G. C. (1984): "Testicular development, epididymal sperm reserves and seminal quality in two-year-old Hereford and Angus bulls: effects of two levels of dietary energy". J. Anim. Sci., 59, p. 432-440.

FOSTER D.L., EBLING F.J.P., MICKA A.F., VANNERSON L.A., BUCHOLTZ D.C., WOOD R.I.: SUTTIE J.M., FENNER D.E (1989): "Metabolic interfaces between growth and reproduction. I. Nutritional modulation of gonadotropin, prolactin, and growth hormonesecretion in the growth-limited female lamb". Endocrinology, 124, p. 342-350.

GODFREY R.W., COLLINS J.R., GRAY M.L (1998): "Evaluation of sexual behavior of hair sheep rams in a tropical environment". J. Anim. Sci., 76, p. 714-717.

MARCO-JIME'NEZ F., PUCHADES S., GADEA J., VICENTE J.S., VIUDES-DE-CASTRO M.P. (2005): "Effect of semen collection method on pre- and post-thaw Guirra ram spermatozoa". Theriogenology, 64, p. 1756-1765.

MOOROW R. E., ELMORE R. G., BROOKS A. L., LUEBKER J. P. AND BREUER D. J. (1981): "Growth and reproductive development of beef bulls tested on two levels of energy". J. Anim. Sci., 59, p. 432-440.

ÖZDAMAR K. (1999): "Paket Programlar ile İstatistiksel Veri Analizi". I. Kaan Kitabevi, Eskişehir.

PRUITT R.J., CORAH L.R. (1985): "Effect of energy intake after weaning on the sexual development of beef bulls I. semen characteristics and serving capacity". J. Anim. Sci., **61**, 1186-1193.

SUTAMA K. I., EDEY T.N. (1986): "Postpubertal sexual development in Merino rams after differential feeding through puberty". Theriogenology, 25, p. 601-607.

ZAR J. H (1996): "Biostatistical Analysis". Prentice-Hall International Inc., 3rd edition 1996.

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EFFECT OF STORAGE TIME AND SEVERAL SILAGE INOCULANTS ON THE AEROBIC STABILITY OF SORGHUM SILAGES

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ABSTRACT - Effect of the storage time and several silage inoculants on the aerobic stability of sorghum silages

Aerobic stability of silages has great importance in practice. When the silo is opened, yeasts and moulds can grow due to exposure to the air. The process cause significant loss of nutrients and harmful silage will be produced. There are lot of published results on the fermentability, the nutritive value and digestibility of sorghum silages, but we have only limited knowledge about their aerobic stability. The aerobic stability is affected by several factors. As the sugar content is high one of the most important fact is the amount of easily fermented carbohydrate remaining after the fermentation – in case of sorghum silage.

In this paper we report the aerobic stability of sorghum silages changing in the function of storage time, using inoculants *Lactobacillus buchneri* (NCIMB 40788), *Propionibacterium acidipropionici* (MA 26/4U) and the preservative product Lalsil Fresh.

Four treatments were used (T1 untreated control, T2 treated with *Lactobacillus buchneri* $3x10^5$ CFU/g FM, T3 treated with *Propionibacterium propionici* $3x10^5$ CFU/g FM, T4 treated with 0.005 g/kg Lalsil Fresh). The Lallemand inoculant "Lalsil Fresh" contained selected strain of *Lactobacillus buchneri* (NCIMB 40788 $6x10^{10}$ CFU/g). Sorghum (Róna 1) was ensiled immediately after harvest, chopped to about 1-1.5 cm size, mixed with additives and ensiled in 4.2 L jars. The jars were incubated at 20+/-2 °C. Five jars per treatment were sampled on day 14, 28, 42, 56 and after 140 of storage. The aerobic stability, chemical and microbiological parameters were analysed from the silages.

Strong correlation was observed between the aerobic stability and the storage time of silages. At the beginning of fermentation the aerobic stability was still low but changed better with the progress of time. After complete fermentation, from the eight week of ensilaging stable silages could be observed. The aerobic stability of silages opened on the twentieth week was more than one week. Positive effect of the heterolactic bacteria was established. The aerobic stability was increased moderately by *Propionibacterium propionici*, and significantly *Lactobacillus buchneri*. Lalsil Fresh had the best effect on aerobic stability. All the treated silages opened on the twentieth week had better aerobic stability than the untreated.

Keywords: sorghum silages, aerobic stability, storage time, microbial inoculants

INTRODUCTION

Due to the climate changes caused by global warming, the numbers of droughty years are increasing, and that is while the cultivation of xerotolerant plants becomes important. It is well known that sorghum (*Sorghum bicolor L.*) belongs to drought resistant plants. Sorghum – as a forage-plant – has numerous advantages and some disadvantages properties. The sorghum is able to produce (depending on the drought weather) 10-30% more yield than silo maize. Due to the high sugar content of sorghum fermentation starts more rapidly, the pH decreases and the interval of auto-oxidation shortens. These conditions are favourable to lactic acid bacteria for fermentation (AVASI ET AL., 1997,

2001). Aerobic stability of silages has great importance in practice. When the silo is opened, yeasts and moulds can grow due to exposure to the air. The process cause significant loss of nutrients and harmful silage is produced (URIARTE ET AL. 2001). The aerobic stability is affected by several factors (initial microbial populations, density of the silage, exposure to air, exposure time, stage of maturity, DM content, ambient temperature, residual water soluble carbohydrate) (OHYAMA ET AL., 1975; WOOLFORD, 1978). As the sugar content is high one of the most important fact is the amount of easily fermented carbohydrate remaining after the fermentation – in case of sorghum silage. The residual WSC content is also relatively high and because of this the silage can spoil easier (WOOLFORD, 1990). Due to the fairly high carbohydrate content the aerobic stability of sorghum silage has been intensively studied. Supplementation with lactic acid bacteria during ensiling sorghum improved the fermentation process, but reduced the aerobic stability of the silage (MEESKE ET AL., 1993). The effect of heterofermentative bacterium *L. buchneri* has been investigated on the aerobic stability of sorghum silage. The bacterium decreased the growth intensity of yeasts and moulds, and it was established the aerobic stability of silages improved (FROETSCHEL ET AL., 1995; FILYA ET AL. 2002; WEINBERG ET AL., 2002).

MATERIAL AND METHOD

Four treatments were used (**T1**= untreated control, **T2**= treated with *Lactobacillus buchneri* $3x10^5$ cfu/g FM, **T3**= treated with *Propionibacterium acidipropionici* $3x10^5$ cfu/g FM, **T4**= treated with Lalsil Fresh 0.005 g/kg → $3x10^5$ cfu/g FM). The Lallemand inoculant „Lalsil Fresh" contained selected strain of *L. buchneri* (NCIMB 40788, $6x10^{10}$ cfu/g).

The sorghum (varieties Róna 1 from the research station of the Cereal Research Ltd. Szeged) was harvested at the doughty stages of maturity, and was ensiled immediately after harvest, chopped to about 1-1.5 cm size, mixed with additives and ensiled in 4.2 L jars. Silage density was 210 kg DM/m^3 +/-3%. The jars were stored at ambient temperature 20+/-2 °C.

Five jars per treatment were sampled on day 14, 28, 42, 56 and after 140 of storage.

The chemical and microbiological parameters and the aerobic stability were analysed from the silages. Dry matter content and crude nutrients (crude protein, crude fibre, crude fat, ash, nitrogen-free extract) were measured according to the Hungarian National Standards. The WSC (water soluble carbohydrate) was determined according to Mac Donald and Henderson, using anthron reagent and sulphuric acid, applying spectrophotometer. The content of lactic acid and volatile fatty acids was examined with ACME Joung Lin 6100 gas chromatograph device. The ammonia content from watery extract was measured with OP246/1 NH_3 measuring device. The number of yeast and mould colonies was determined on the basis of the Hungarian standard (MSZ ISO 7954).

The silages were tested for aerobic stability by HONIG (1986) method. For this purpose, 500 g of silage was put into an isolating box, and stored at environmental temperature of 20-22 °C. The temperature was measured in every hour. The rise of silages temperature was measured through 10 days. Aerobic stability was defined as the time passed until the temperature increased 3 °C above ambient temperature.

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RESULTS AND DISCUSSION

The dry matter content of the fresh crops sorghum was 34.2 %. The chemical composition of sorghum on the basis of dry matter was: crude protein 64.3 $g.kg^{-1}$, crude fat 31.1 $g.kg^{-1}$, crude fibre 270.6 $g.kg^{-1}$, ash 64.9 $g.kg^{-1}$, WSC 424,8 $g.kg^{-1}$ (mean value, n=3).
The fermentation parameters of the silages after 2,4,6,8 and 20 week storage time are shown in *Table 1.*

Table 1. Fermentation parameters of sorghum silages on fresh basis

Storage time	Parameters		Treatments			
			T1	T2	T3	T4
2 weeks	Lactic acid	%	0.97	2.14	2.41	2.21
	Acetic acid	%	0.34	0.64	0.71	0.72
	Butyric acid	%	0.00	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.02	0.000
	pH		4.53	4.26	4.16	4.10
	NH_3-N	% of TN	9.16	10.98	9.08	9.18
4 weeks	Lactic acid	%	1.13	1.89	2.26	2.00
	Acetic acid	%	0.55	1.24	0.83	1.36
	Butyric acid	%	0.04	0.00	0.00	0.00
	Propionic acid	%	0.004	0.000	0.01	0.000
	pH		4.66	4.17	4.15	4.10
	NH_3-N	% of TN	10.37	9.68	8.15	8.23
6 weeks	Lactic acid	%	1.25	1.72	1.77	1.82
	Acetic acid	%	0.48	1.32	0.74	1.14
	Butyric acid	%	0.06	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.03	0.000
	pH		4.94	4.19	4.22	4.22
	NH_3-N	% of TN	8.02	7.61	6.68	6.27
8 weeks	Lactic acid	%	1.06	1.75	1.33	1.98
	Acetic acid	%	0.43	1.21	0.87	1.33
	Butyric acid	%	0.04	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.03	0.000
	pH		5.29	4.20	4.35	4.46
	NH_3-N	% of TN	11.64	8.94	8.28	8.77
20 weeks	Lactic acid	%	1.28	1.62	1.48	1.72
	Acetic acid	%	0.55	1.31	1.18	1.36
	Ratio LA:AA		2.33:1	1.24:1	1.25:1	1.26:1
	Butyric acid	%	0.06	0.00	0.00	0.00
	Propionic acid	%	0.000	0.000	0.06	0.000
	pH		5.29	4.35	4.44	4.47
	NH_3-N	% of TN	13.94	10.24	10.15	9.75

It can be seen that intensive fermentation was going on in the treated silages (T2, T3, T4) already in the first two weeks, and the lactic acid, acetic acid content was higher, the pH was lower than in the untreated control silages (T1).

Further fermentation resulted in lower lactic acid but more acetic acid amount in the treated silages. After the 20 weeks storage time the ratio of lactic acid: acetic acid was about 1,25:1.

The pH and ammonium content of treated silages were significantly lower than in the control.

Data concerning the aerobic stability and dry matter loss are shown in *Table 2.*

Comparing the aerobic stability of the treated silages with the control the treated samples can be considered much better after 2 weeks storage time and the dry matter loss is much lower in these treated silages. That is positive correlation was observed between the storage time and the aerobic stability, and negative correlation between the storage time and the dry matter loss. After 20 weeks storage the aerobic stability of treated silages was more than 300 hours (*Fig.1*), and during exposition to air lasting 10 days resulted in less than 1% dry matter loss.

Table 2. Aerobic stability of silages and dry matter loss after 10 day exposition to air

Storage time	Parameters		Treatments			
			T1	T2	T3	T4
2 weeks	Aerobic stability	hour	69	93	85	127
	Dry matter loss	%	12.0	11.0	11.2	6.7
4 weeks	Aerobic stability	hour	89	85	84	120
	Dry matter loss	%	11.1	10.2	10.0	8.6
6 weeks	Aerobic stability	hour	93	195	127	>240
	Dry matter loss	%	6.2	3.0	6.9	<1
8 weeks	Aerobic stability	hour	170	169	>190	>190
	Dry matter loss	%	4.8	4.9	4.1	3.0
20 weeks	Aerobic stability	hour	200	>300	>300	>300
	Dry matter loss	%	6.6	<1	<1	<1

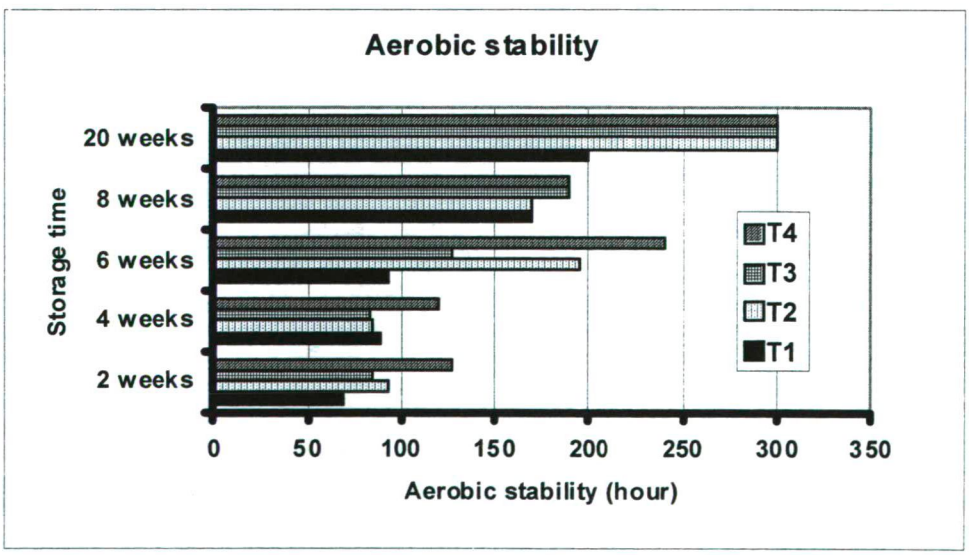

Fig.1. Aerobic stability of the control and treated silages

The results of microbiological experiments verified the positive effects of inoculant on the aerobic stability of silages (*Table 3*). In the presence of *L. buchneri* bacteria (T2, T4) the number of moulds was 1-2 order of magnitude lower than in the control after 10 days exposure to air.

Table 3. Number of mould and yeast cells at opening of silos (after 20 weeks storage time) and after 10 days exposure to air

Treatment	Number of cells (yeasts and moulds) log_{10} cfu/ g fresh matter			
	At opening		After 10 days exposure to air	
	Yeasts	Moulds	Yeasts	Moulds
T1	<1	<1	<1	8.2
T2	<1	<1	<1	6.7
T3	<1	<1	<1	7.4
T4	<1	<1	<1	5.7

REFERENCES

AVASI, Z.-J. P. SZŰCSNÉ-K.I. MÁRKI-ZAYNÉ (2001): Advantages and disadvantages of the combination of maize and sorghum for silage. 52th Annual Meeting of European Ass. For Animal Production, Budapest, HUNGARY

AVASI, Z.-P. J. SZŰCSNÉ-K.I. MÁRKI-ZAYNÉ (1997): Data for the fermentation and nutrition value of silage Sorghum. 8th Int. Symp. of Forage Conservation, Brno, 128-129 pp.

FILYA, I.-SUCU, E. (2002): Effect of enzyme-lactic acid bacteria mixture silage inoculants on the fermentation, aerobic stability, cell-wall content and in situ rumen degradability of wheat, sorghum and maize silages in Turkey. 13th Int. Silage Conf., Auchincruive, 11-13. sept. SCOTLAND

FROETSCHEL, M.A.-NICHOLS, S.W.-ELY, L.O.-AMOS, H.E. (1995): Effect of silage inoculant on the fermentation and digestibility of tropical corn and sorghum silages. Dairy Sci. 95. 203-211 pp.

HONIG, H. (1986): Evaluation of aerobic stability. Procedings of the Eurobac Conference. Upsala, 76-81 pp.

MEESKE, R.-ASHBELL, G.-WEINBERG, Z.G.-KIPNIS, T. (1993): Ensiling forage sorghum at two stages of maturity with the addition of lactic acid bacteria inoculant. Anim. Feed Sci. Technol. 43. 165-175 pp.

OHYAMA, Y.-MASAKI, S.-HARA, S. (1975): Factors influencing aerobic deterioration of silages and changes in chemical composition after opening silos. Jour. Sci. Food Agric. 26: 1137-1147 pp.

URIARTE, M.E.-BOLSEN, K.K.-BRENT, B.E. (2001): Aerobic deterioration of silage. 10th Int. Symp. of Forage Conservation, Brno, 25-36 pp.

WEINBERG, Z.G.-ASHBELL, G.-HEN, Y. (2002): The aerobic stability of whole-crop wheat, corn and sorghum silages. 13th Int. Silage Conf. , Auchincruive, 11-13. sept. SCOTLAND

WOOLFORD, M.K. (1978): The aerobic deterioration of silage. ARC Research Review (4) 8-12 pp.

WOOLFORD, M.K. (1990): The determinal effects of air on silage. Journ. Appl. Bact. 68. 101-116 pp.

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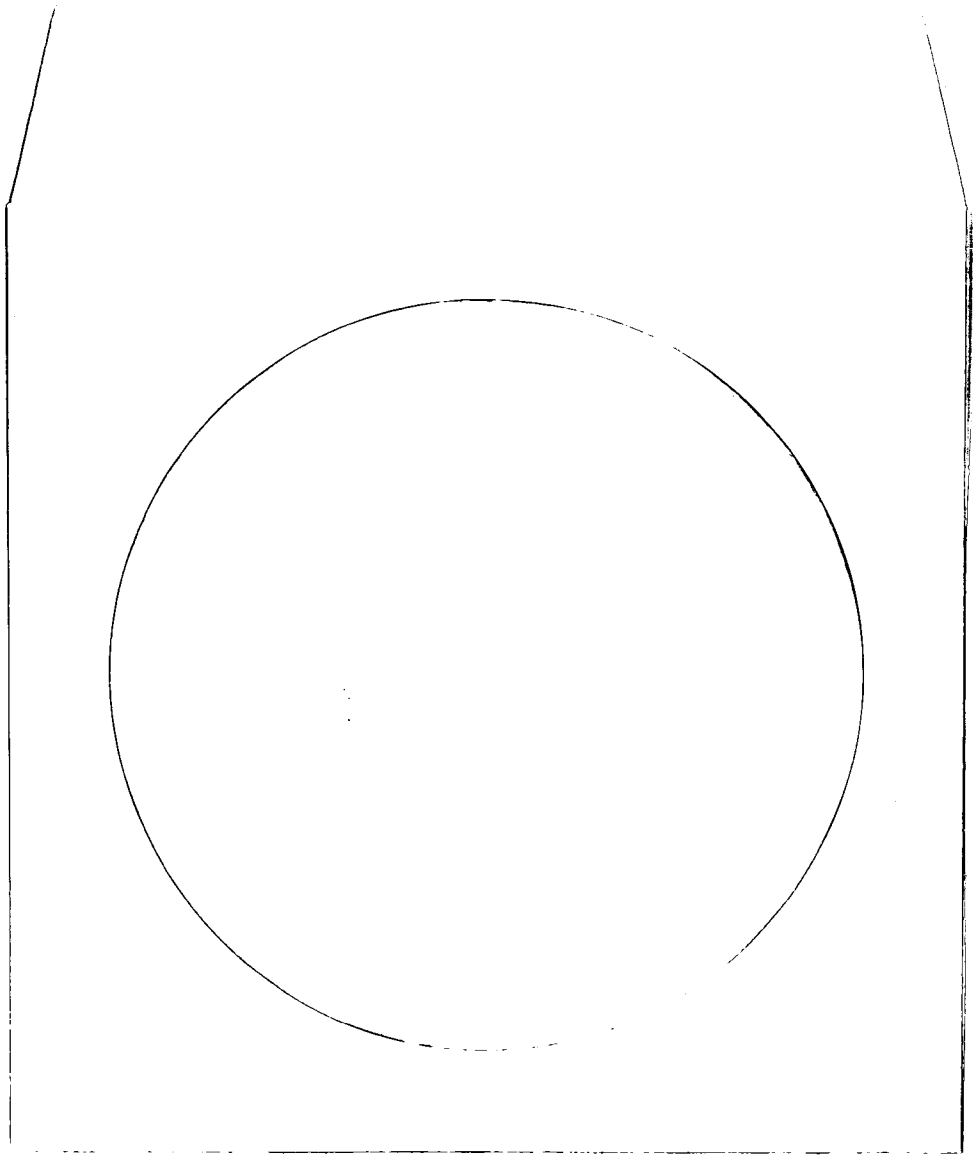

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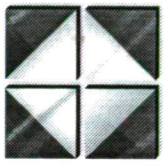

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